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Cover: Preventing potential frost damage by long pruning at Fetzer Vineyards, Mendocino County, CA. Photo by Don Neel.

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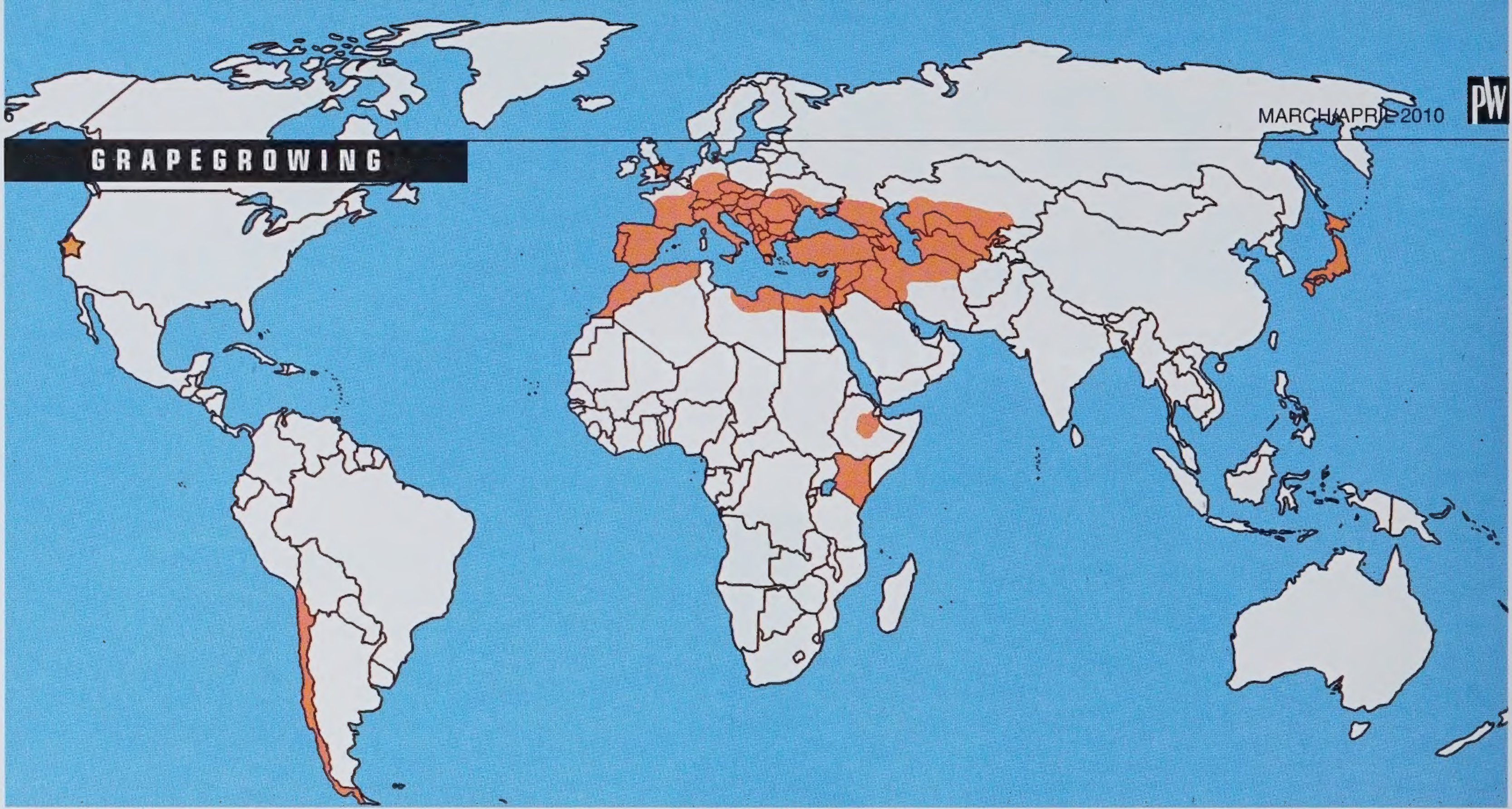


Figure 1. World distribution of *L. botrana* adapted from Distribution Maps of Pests (CIE 1974), with additions of findings reported later.

MONITORING, CONTROL, GRAPE DAMAGE

European grapevine moth, *Lobesia botrana,* in Napa Valley vineyards★

BY Lucia G. Varela, Rhonda J. Smith, Monica L. Cooper, Richard W. Hoenisch, University of California

European grapevine moth, *Lobesia botrana,* has recently been found for the first time in the United States. This moth belongs to the family Tortricidae. Unlike other tortricid moths that are grapevine pests, such as the orange tortrix (*Argyrotaenia franciscana*) and omnivorous leafroller (*Platynota stultana*), European grapevine moth larvae do not roll or feed on leaves — they feed on flower parts and inside the berries.

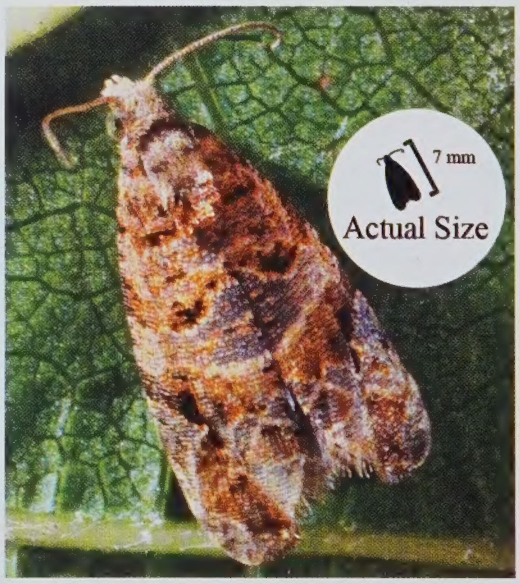
In Europe this moth also has the common names berry and vine moth; these names are shared with similar species worldwide including the eastern U.S. It is important to verify the scientific name *L. botrana* when searching the literature for information on this pest.

Situation in Napa County

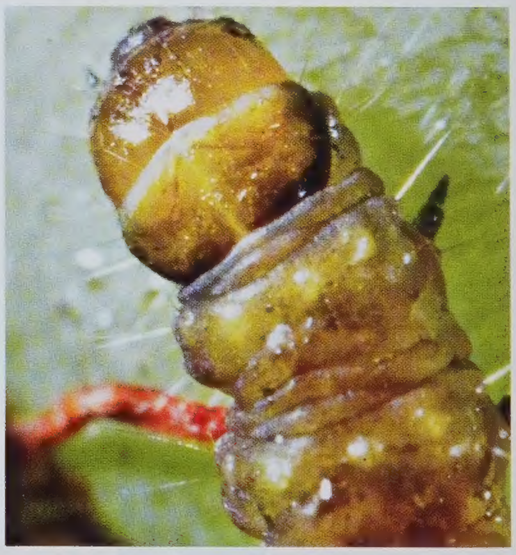
In mid-September 2009, the first report of the European grapevine moth in North America was confirmed in Napa County, CA. Based on available data at the end of 2009, geographic distribution within the state of California (at press time) is considered to be limited to Napa County. The greatest number of confirmed specimens has been collected in the Oakville and Rutherford American Viticultural Areas, although an isolated population has also been located east of the town of Napa.

Movement of fruit, personnel, and machinery, as well as natural dispersal and the climatic suitability of various regions of California, make this pest a serious threat to other areas of the state.

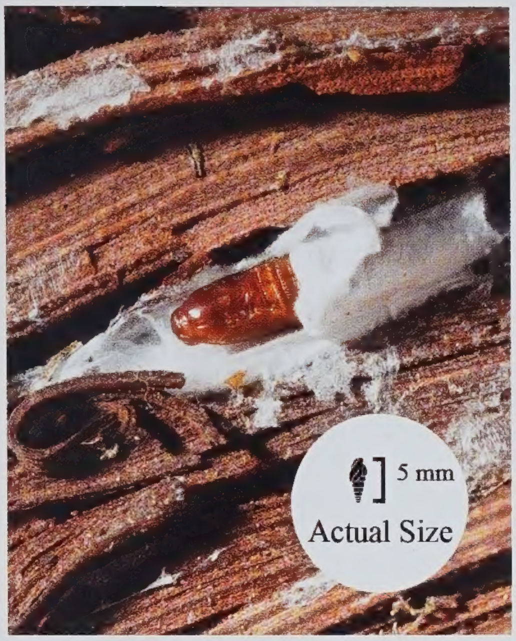
Following its detection, a coalition of agencies — the U.S. Department of



European grapevine moth female – photo Jack Kelly Clark, courtesy of UC Statewide IPM Program



European grapevine larva with dark border on rear edge of prothoracic shield – photo Jack Kelly Clark, courtesy of UC Statewide IPM Program.



European grapevine moth pupa inside partially open cocoon found under the bark. Photo Jack Kelley Clark, courtesy of UC Statewide IPM Program.

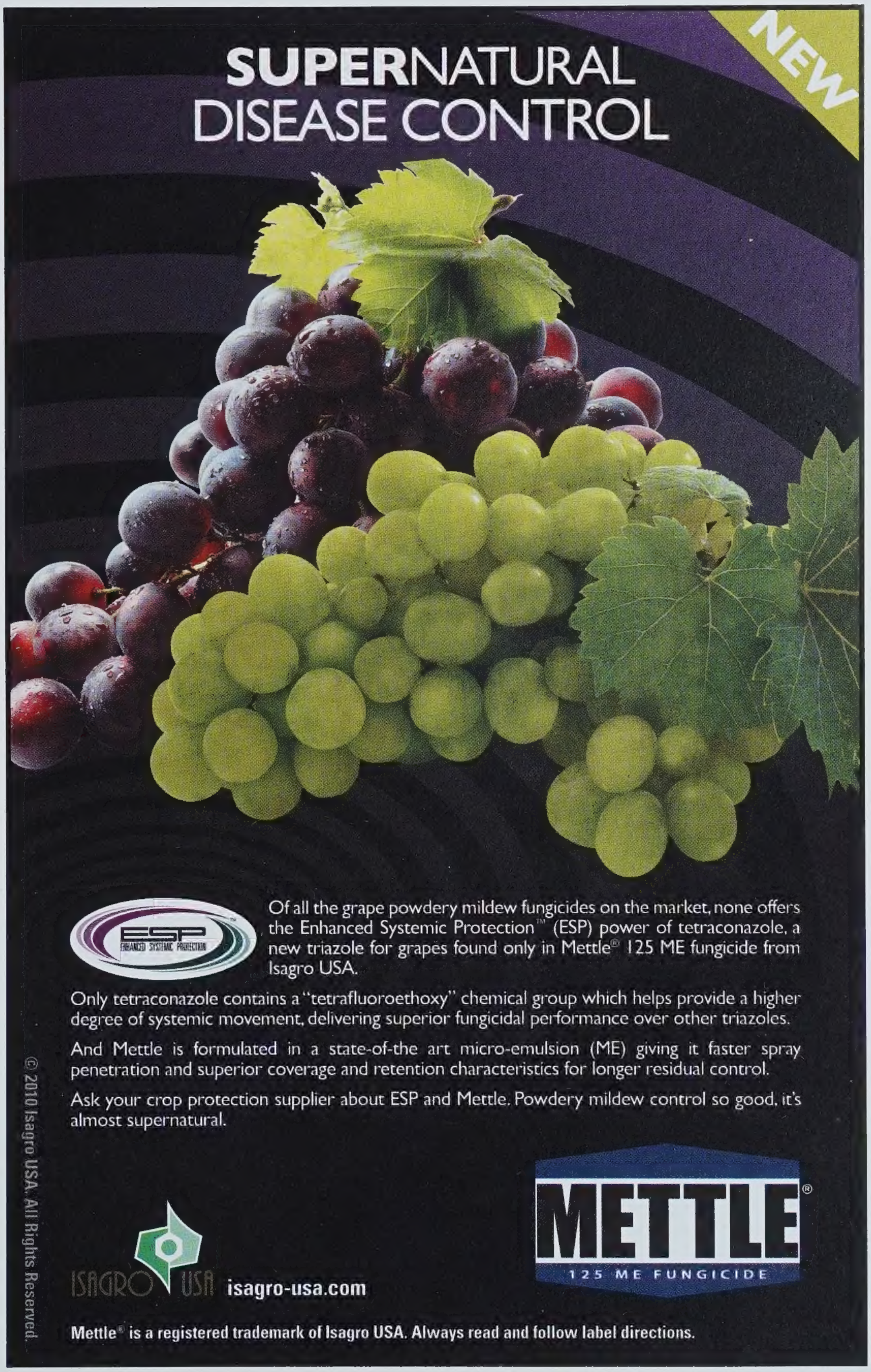
Agriculture, California Department of Food and Agriculture (CDFA), and Napa County Agricultural Commissioner — deployed 248 pheromone-baited traps in Napa County to aid in delimiting *L. botrana* populations. These traps were monitored from October 7 to October 26, 2009, during which time six male moths were collected. The low number is presumably the result of the population age (late-instar larvae to overwintering pupae) when the traps were deployed.

Ground surveys for immature insects by vineyard, regulatory, and UC Cooperative Extension personnel were more fruitful. Almost 30 individual properties in Napa County are now presumed positive for at least one life stage of *L. botrana*. By November 2009, trapping efforts had ended for the season, concurrent with the lack of a population in the adult stage.

In late winter/early spring 2010, trapping efforts will resume in Napa County, and expand throughout California to determine statewide distribution of *L. botrana*. Considering its status as one of the most damaging pests of

Dave Whitmer, Napa County Agricultural Commissioner, confirmed the European grapevine moth caused significant losses in 2009 in several Napa Valley vineyards. In later generations, the larvae enter the grape berries to feed, spreading Botrytis sp. and other rots.

"An intensive trapping effort in Napa County deployed almost 250 traps within about 48 hours of the initial find," reports Whitmer. "Unfortunately, the timing put us at the very end of the adult flight, so only six adults were attracted to the traps. We plan to re-deploy delimitation traps early this spring and believe we will find additional locations beyond the 29 properties we have confirmed at present."



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grape berries in the Mediterranean region, and its recent rapid spread in Chile, this state-wide monitoring effort will be critical to delimit populations to track the pest's spread and damage in California vineyards.

Currently, the European grapevine moth has been classified as a Q-rated pest by the CDFA, a temporary rating pending determination of a permanent rating. Once adequate information has been collected on its statewide distribution, *L. botrana* will then be assigned an A, B, or C rating.

Pests with an **A-rating** are organisms of recognized economic importance that are subject to state-enforced action involving eradication, quarantine regulation, containment, or rejection; **B-rated** pests generally have established, but not widespread populations, are recognized as economically damaging, and are subject to regulatory action at the discretion of the Agricultural Commissioner at the local level. **C-rated** pests are recognized as generally distributed, and are therefore not subject to regulatory action except to retard spread, and at the nursery level to assure pest-free plants.

During the 2009 harvest, quarantine zones and compliance agreements established for the light brown apple moth (*Epiphyas postvittana*) in Napa County may have limited the movement of European grapevine moth.

Geographic distribution

L. botrana was first described by biologists Denis and Schiffermüller in 1775 in Vienna, from samples collected in Italy, and was classified as a pest in Austria in 1800. It was reported from several European countries and Russia in the 1800s and has since spread to North and West Africa and the Middle East. It was introduced into Japan before 1974 and recently into Chile.

Climates in the area occupied by the pest can be characterized generally as dry or temperate. The currently reported global distribution of *L. botrana* suggests that the pest may be most closely associated with habitats classified as montane scrub, Mediterranean scrub, and temperate broadleaf and mixed forest.

The Chilean department of agriculture, Servicio Agrícola y Ganadero (SAG), issued the first report on *L. botrana* in the Americas on April 23, 2008. Surveys conducted in 2008 and 2009 show infestations in all grapegrowing regions of Chile, a spread of approximately 1,500 kilometers (930 miles).

Hosts

European grapevine (*Vitis vinifera*), American bunch grape (*V. labrusca*), and spurge laurel (*Daphne gnidium*), a common shrub in Mediterranean Europe, are the main hosts. Some researchers theorize that *D. gnidium* constitutes the original host of *L. botrana* and its adaptation to grapes is a relatively recent event.

The larva feeds on all cultivated grape varieties, although they develop better on some than on others. Females lay eggs almost exclusively on flower clusters and berries.

The literature includes about 25 hosts other than grape, however *Lobesia* is found only very rarely or accidentally on other hosts with the exception of *D. gnidium. Vitis vinifera* constitutes the main food resource.

L. botrana is considered a major pest only on grapevines. In olive, only the flowers are infested, never the fruit; therefore, olive trees next to vineyards may constitute an important source of infestation of nearby vines by moths in the late spring.

Females select plants to lay eggs on by flying upwind following olfactory cues. Once they land on a plant they also taste the surface with contact chemoreceptors before laying their eggs. Plant surface chemicals stimulate or deter egg laying. The host-plant range in California will need to be studied to establish the role that alternate hosts play in the life cycle of *L. botrana.*

Identification

The adult moth is approximately ¼ inch long. Female moths tend to be slightly larger, although both sexes have mosaic-patterned wings. The first pair of wings is tan-cream and mottled with gray-blue, brown, and black blotches. The second pair of wings is gray with a fringed border.

Unlike other common vineyard tortricids, which lay eggs in overlapping masses, *L. botrana* lays single, elliptical, and flat eggs (0.03 inches in diameter). As it ages, the iridescent, creamy white egg turns yellow, and later blackens as the head of the developing larva forms. The larva hatches from the edge of the egg, leaving the translucent egg shell attached to the plant.

Both sexes have five larval instars; fully grown larvae are approximately ½ inch long with dark thoracic legs. First-instar larvae are creamy white with a black head. Older larvae have lighter, yellowish-brown heads with a dark border at the rear edge (closest to the body) of the prothoracic shield (segment behind the head; see photo). Young larvae have tan bodies, whereas older larvae take on the color of their gut contents and food source (from dark green to shades of maroon).

Fifth-instar larvae spin a grayish-white silken cocoon in which they pupate. The pupa is approximately ¼ inch long.

Life cycle

In the Mediterranean region, *L. botrana* typically completes two to three generations per year. Using 50°F (lower) and 86°F (upper) thresholds, we tentatively estimate degree-days Fahrenheit to be 833 for the first generation and 904 for the remaining generations.

First generation flights may begin near bud break and continue for four to five weeks; males begin emerging roughly one week before females. Adults live one to three weeks, fly at dusk (above 54°F), and mate in flight (1 to 6 days after emergence). Females generally mate once in their lifetime.

Egg-laying begins one to two days after mating, with each female laying 80 to 160 eggs. Eggs of the first generation — laid singly on flat surfaces near or within the flower cluster — hatch in 7 to 11 days. Larvae web together individual flowers to form "nests" prior to and during bloom, and feed inside the web.

Under optimal conditions of 80° to 85°F and 40% to 70% relative humidity, larval development is completed in 20 to 30 days. Pupae form inside webbed cocoons in the flower cluster, in a folded lobe of a leaf blade, under the bark, or in soil cracks. Adults emerge 6 to 14 days after pupation.

Eggs of second and third generation females — laid singly on shaded

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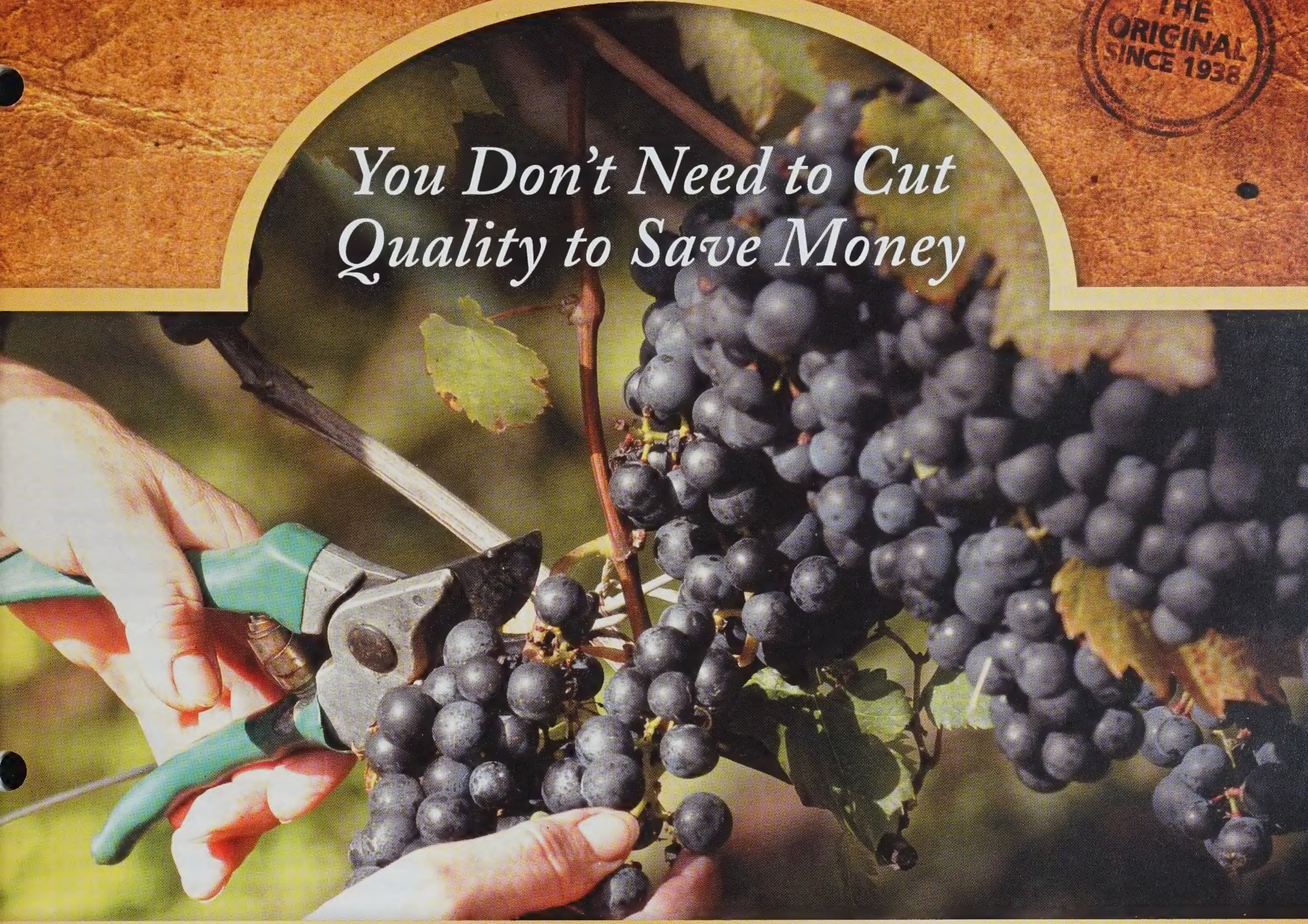

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berries — hatch in 3 to 5 days. A grape cluster is typically infested with multiple larvae that feed individually inside berries. Larvae fed on higher-quality food (ripe fruit or fruit infested with *Botrytis cinerea*) grow into larger, longer-lived adults that lay greater numbers of eggs. Therefore, later-season generations have the potential to cause greater crop damage than early-season generations.

In autumn, nights longer than 11 hours during egg and/or larval development initiate diapause (a resting state). A diapausing pupa withstands colder temperatures than a non-diapausing pupa and can tolerate even the coldest northern European winters. In early February, during post-diapause development, prior to adult emergence, pupae may die at temperatures below 46°F.

Damage

L. botrana larvae feed on all parts of the flower cluster in early spring, but more importantly they feed on berries in midsummer and again in late summer, continuing through harvest and into leaf-fall. Feeding triggers infections by the fungus *Botrytis cinerea* and other rot organisms resulting in bunch rots that are the main cause of fruit loss.

Larvae of the first generation of *L. botrana* hatch from eggs laid in flower clusters and damages portions of the cluster.

Second generation larvae hatch from one egg per berry prior to veraison, starting about when berries are pea-size and feed inside webbing. Damage is caused by direct feeding on the berries. A dark spot surrounds the point of larval feeding and several berries can be damaged.

Third generation larvae can cause the most damage to clusters, preventing them from being harvested for wine grape production. Larvae penetrate and feed on ripening fruit immediately after hatching.

Infested clusters contain shriveled berries, webbing, and excrement. Feeding holes can be seen in several berries. Shreds of berry epidermal tissue loosely attached to pedicels are present, as are dry, somewhat intact "skins" of fully excavated berries. Bunch rot is present, and depending on climate, the summer bunch rot complex will develop which includes secondary fungal invaders.

Monitoring

Monitoring methods for *L. botrana* in California vineyards may not be identical to strategies used in Europe or other regions where this pest is common; however the objective is the same — to decrease yield losses caused by the feeding damage of this insect. Strategically timed insecticide applications are required to control this pest and, depending on the generation targeted and the material applied, it is essential to identify either the beginning of egg laying or egg hatch.

Monitoring male flights with a commercially available *L. botrana* pheromone lure over the entire 2010 grape growing season is advised at this time. Red delta sticky traps, identical to those used for monitoring vine mealybugs, are ideal for this purpose, and should be attached to the trellis immediately above the canopy. Place one trap per 30 vineyard acres, or at least one per ranch in small vineyards.

The lure should be replaced according to manufacturer's instructions, and insects removed from the trap bottom after counting. Replace soiled traps as needed to maintain a sticky bottom. Trapping for *L. botrana* males should begin at bud break and trap-catch numbers should be recorded weekly.

Trapping is used to determine when the adults are active, which helps predict egg-laying activity. There is no close correlation between the number of trapped males and actual population densities. If very few or no males are caught, little to no damage would be predicted; however, if any males are trapped, it increases the likelihood that webbing found in clusters is caused by *L. botrana*.

First generation — Once peak trap catch has likely been reached, begin to

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observe 100 flower clusters per block (1 cluster per vine) and look for eggs of the first generation, which are commonly laid on the peduncle (cluster stem). Eggs are lentil-shaped, but slightly smaller. Take note of the egg color and the time it takes to change from white (freshly laid), to yellow, followed by black immediately prior to hatching. A hatched egg can be recognized by the outer shell that remains. If webbing is found, it is important to verify it was caused by a larva and that hatched eggs are also present.

Cool spring temperatures will postpone mating and egg laying. At this time it is not known what effect low temperatures will have on early development of the first generation. Once a degree day model is validated for *L. botrana* in California, the focus of monitoring guidelines for the first generation may be shifted from egg hatch to egg laying.

In Europe, feeding damage to flower clusters is considered low and researchers in Germany have shown that yield is not reduced. As a result, control measures are not directed toward first generation larvae in Europe. Currently in Chile, the first generation is targeted for control measures which are timed according to the presence of eggs.

Because other lepidopteran pests in California cause webbing in grape flower clusters, California growers will have to verify that larvae found in clusters are *L. botrana*. To do so, the larvae must be associated with hatched eggs and adult male trap catches.

In California in 2010, an insecticide application directed to the first generation larvae may be advised if eradication efforts are required. Timing is critical for success; growers and PCAs will have to monitor flower clusters for egg hatch. If larvae are observed and verified to be *L. botrana*, an insecticide can be added to a powdery mildew fungicide application.

Second generation — One week after trapping the first males of both the second and third flights, begin to monitor 100 grape clusters. The berries may be about pea-size when second generation eggs are monitored. Observe a cluster in direct sunlight and look for eggs laid singly on the surfaces

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of berries. Freshly laid eggs will reflect direct light and appear very shiny and white.

As with the first generation, note the timing of egg development and hatch. An insecticide application with a long residual should be directed to small larvae; thus subsequent larvae are controlled as they emerge from eggs or shortly thereafter.

Third generation — The clusters will be past veraison when eggs are monitoried; eggs will be easier to locate on dark fruit. Note the timing of egg development; as in earlier generations, a treatment must be applied when larvae emerge from eggs.

Sometime in the fall, larvae leave grape clusters and pupate under bark on cordons or the trunk. If the vineyard was not monitored with traps during the growing season and an infestation is now suspected, examine any grape clusters remaining in a hand-harvested block. Look for the damage caused by third generation larvae (webbing and frass), and larvae inside damaged berries.

A suspect vineyard may also be scouted for pupae in the fall. This is the only avenue available to growers and PCAs for a vineyard that was mechanically harvested.

Management

Insecticides — Male moth flight, egg laying, and egg hatch must be monitored in order to correctly time the application of insecticide. Once the larvae begin to web flower parts or feed inside berries, chemical control is less effective. Even though the first generation larvae damage is not of economic importance, if eradication efforts are required or populations are very high, controlling the first generation helps lower population levels in the second generation.

Many insecticides effective against European grapevine moth and other lepidopteran pests have recently been developed. Different classes of insecticides have different modes of action. If more than one insecticide application is needed for the control of *L. botrana* rotating chemicals with different modes of action may help prevent the development of resistance. The Insecticide Resistance Action Committee (IRAC) assigns a group number to each mode of action. The group number appears on insecticide labels.

The bacterium *Bacillus thuringiensis* (Bt) produces proteins that are toxic to very specific species of insects. These proteins, once ingested by the insect, act as a stomach poison. The Bt toxin is available in several commercial products that are specific to Lepidoptera (moths and butterflies).

Given that a larva must ingest the insecticide for it to be effective, it is best to apply when warm sunny days are forecast, especially in spring, because the larvae will tend to be active and feed at warmer temperatures. Two applications of a Bt product are recom-

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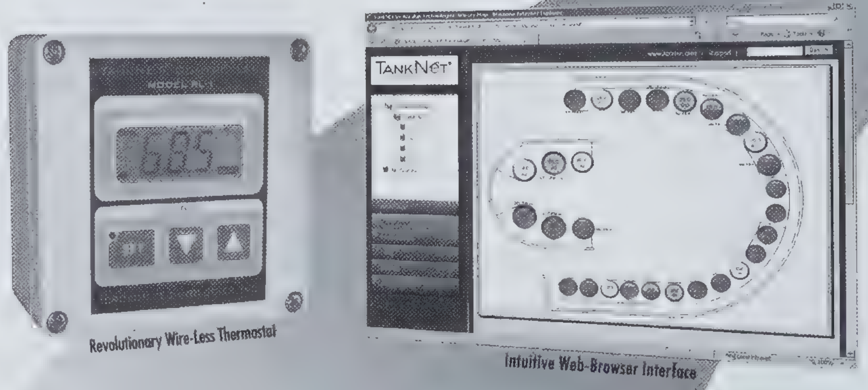

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mended per generation, because egg laying thus larval emergence occur over several weeks. In addition, Bt has a short residual.

Insect growth regulators are effective against many species of lepidopteran insects. These products have lower toxicity to beneficial insects, mites, and pollinators. This class of insecticide prevents the insect from molting into its next growth stage; thus mortality may take several days. If the insect growth regulator affects both the egg and the larvae, application should begin at the start of **egg laying** rather than at the initiation of **egg hatch**.

Spinosad products must be ingested by the insect; therefore it has little effect on sucking insects and non-target predatory insects. It may be toxic to beneficial parasitic wasps if they feed on contaminated honeydew and to honeybees if they come into contact with the spray. There are several commercial spinosad products, both synthetic and organic formulations.

The spinetoram group of pest control chemicals is derived from spinosad that has been chemically modified, resulting in improved insecticidal activity and longer residual activity. However, the longer residual activity may also result in greater toxicity to parasitic wasps.

Other insecticide groups include rynaxypyr, neonicotinoids, pyrethroids, carbamates, and organophosphates. Although each group has a different mode of action, all of these insecticides block the insects' nerve synapses or the conduction of nerve impulses, ultimately causing muscle paralysis.

Biological control — Parasitic wasps can parasitize the eggs of *L. botrana*. Trichogamma species are known egg-parasites of many Lepidoptera species, and can be a good source of biological control of European grapevine moth. In the fall of 2009, egg parasitism was observed in Oakville in vineyards with *L. botrana* damage.

Studies are needed to determine how early in the season Trichogamma species begin to parasitize *L. botrana* eggs, if other species of native parasites attack the larval or pupal stages, and the impact these

Continued on page 74

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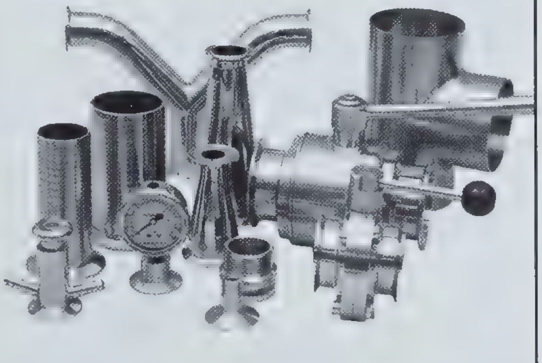

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Post-bottling management of oxygen to reduce off-flavor formation and optimize wine style

BY **Maurizio Ugliano, Mariola J. Kwiatkowski, Brooke Travis, I. Leigh Francis, Elizabeth J. Waters, Markus J. Herderich, Isak S. Pretorius**
The Australian Wine Research Institute, Glen Osmond (Adelaide), SA, Australia

Between the extremes of too much or too little oxygen after bottling lies a range of different combinations of chemical reactions and interactive wine aroma compounds that contribute to desirable varietal, regional, and style differences. Achieving this balance in Sauvignon Blanc wines has some special challenges: preserving the thiol compounds responsible for its varietal signature by minimizing oxygen exposure may also increase the risk of higher accumulation of undesirable sulfur compounds. Copper addition at bottling is a tool that is often used to reduce the levels of undesirable sulfur compounds. The "good" fruity thiol compounds can also be removed with copper addition. Residual copper may also accelerate other oxidative reactions, resulting in further loss of the "good" thiols. Understanding how aroma compounds react with oxygen under different conditions and in different wine backgrounds is necessary for informed decision-making with regard to bottling and packaging.

The exposure of grape and wine constituents to the action of oxygen occurs at virtually all stages of the winemaking process. In a complex matrix such as wine, oxygen can be involved in an infinite range of reactions, potentially affecting components of primary sensory importance, including phenolic and aroma compounds, directly or indirectly.

Typically, the oxidation of wine occurs through a cascade mechanism in which oxygen, in conjunction with oxidation catalysts such as iron and copper, leads to the formation of free radicals (highly reactive chemical compounds) and/or peroxides, which can, in turn, react with other species (chemical wine compounds). As a result, the action of oxygen on wine components is much broader than the specific ability of individual components to react with oxygen.

Compounds which are known not to oxidize easily in the presence of oxygen alone, can be dramatically affected by exposure of a wine to oxygen, due to the mediation of different chemical species, and in particular, phenolic compounds.

Changes in wine aroma characteristics due to oxygen exposure have great importance for consumer acceptance and preference. In finished wines, two main factors determine the degree of exposure of wine to oxygen, namely total oxygen at bottling (the sum of dissolved and headspace oxygen), and the amount of oxygen entering the bottle through the closure over time.

Oxygen is a powerful modulator of wine aroma profile, and too much or too little oxygen can result in the appearance of serious faults during winemaking and wine ageing, particularly in the formation of abnormal concentrations of compounds responsible for reductive or oxidative off-flavors.

Recently, it has been reported that up to 48% of the wines rated as faulty by judges in wine competitions exhibited off-flavors that can be linked to the erroneous management of oxygen (Vidal 2009, personal communication). While inadequate management of oxygen during winemaking can certainly result in

KEY MESSAGES IN A BOTTLE

- Several wine compounds that are important for the expression of varietal, regional and wine-style differences, are sensitive to oxidation.
- All other things being equal, reducing the amount of oxygen available after bottling will increase the likelihood of reductive characters developing in wines which have a propensity to become reductive.
- Copper fining at bottling to prevent reductive off-flavor development may not always be effective and can result in the loss of desirable compounds in Sauvignon Blanc wines.
- Residual copper in wines as a result of excessive or unnecessary copper fining, combined with oxygen exposure, can accelerate oxidative reactions.
- Individual wines will respond differently to the availability of given amounts of oxygen after bottling. Consequently, wine producers should consider factors such as their own winemaking practices and how their wines respond empirically to oxygen availability after bottling when determining the bottling variables they use for each wine, including their choice of closure.

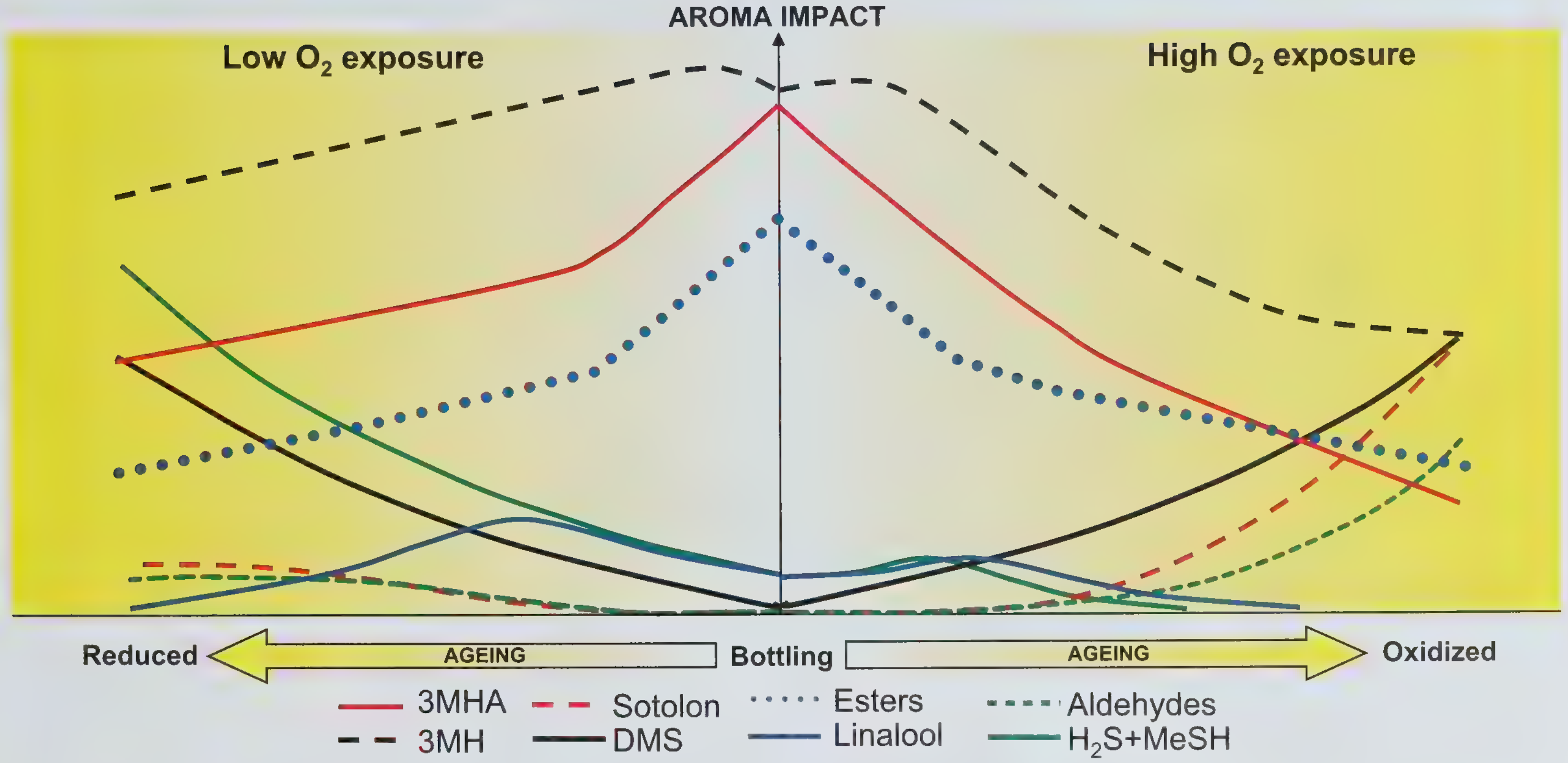

Figure 1. Theoretical representation of the evolution of the impact of some aroma compounds during ageing of wine under different oxygen regimes.

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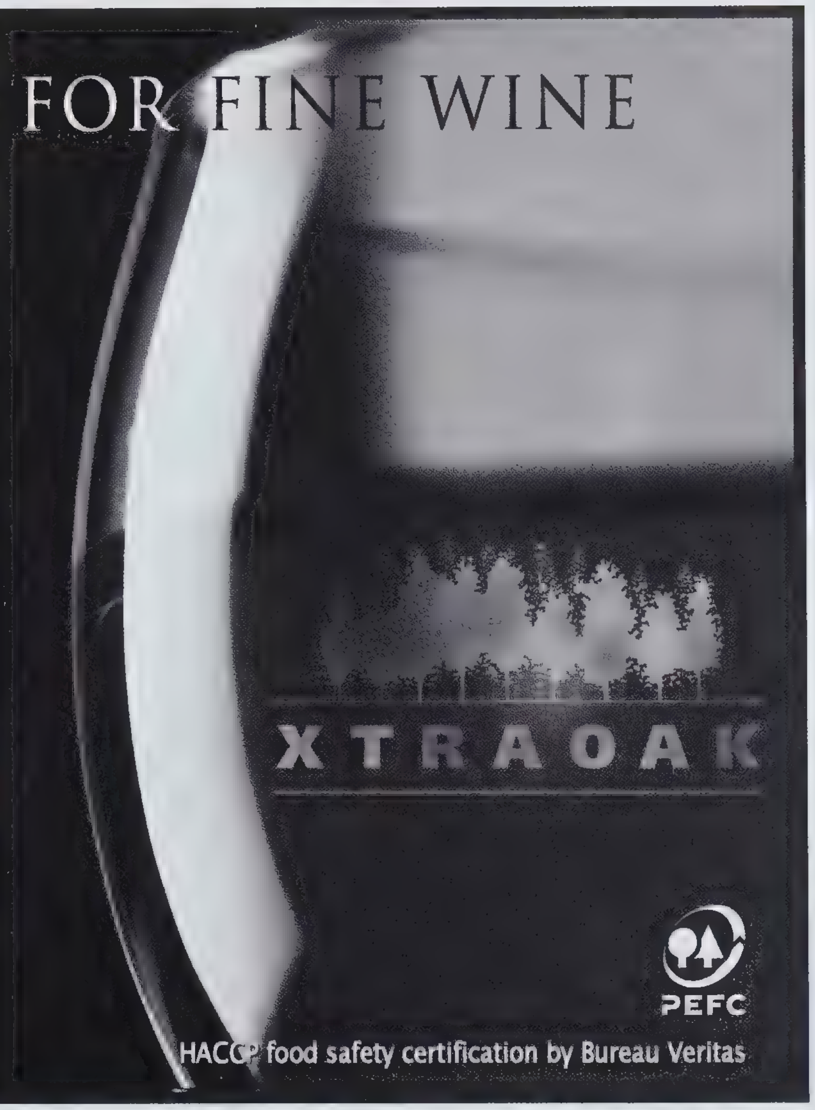

Figure 2

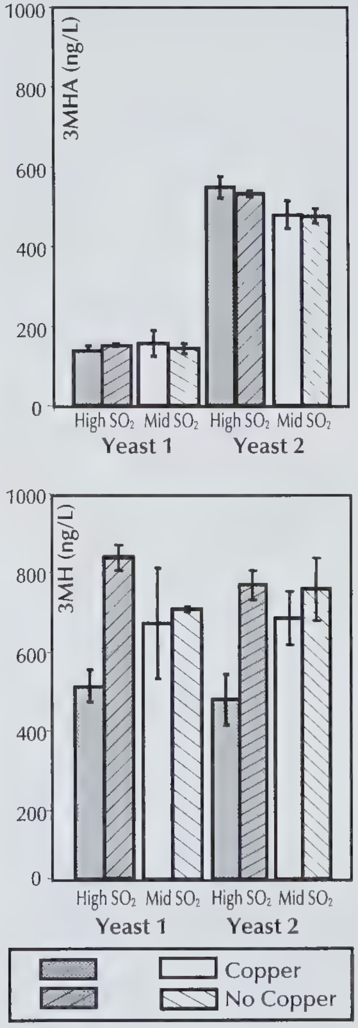

FIGURE 2: Effect of copper addition and SO_2 on the concentration of the fruity thiols 3-mercaptohexanol (3MH) and 3-mercaptohexanol acetate (3MHA) in Sauvignon Blanc wines made with two different yeast strains. Data relate to samples analyzed within 48 hours of bottling. Copper was added at a concetration of 0.2 mg/L.

Figure 3

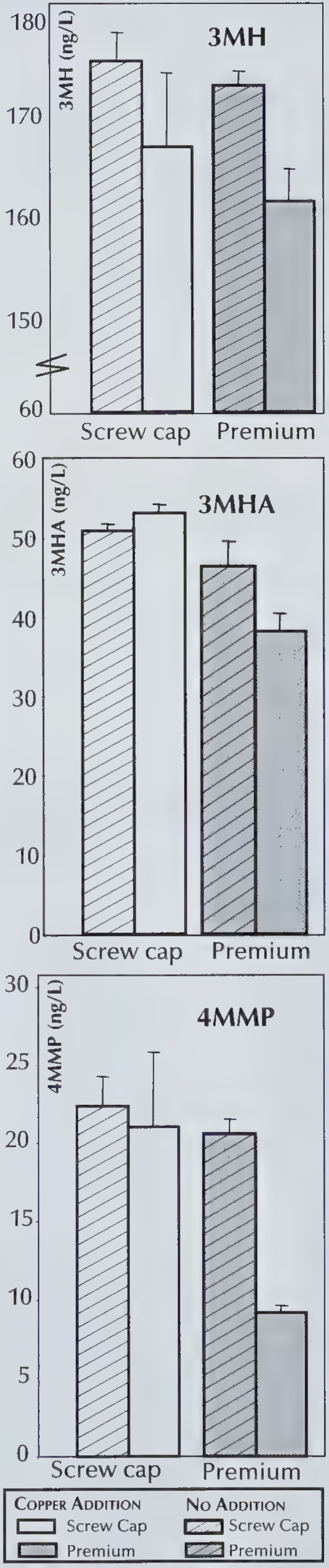

FIGURE 3: (RIGHT) Effect of copper addition and closure type on the concentration of Sauvignon Blanc varietal sulfur compunds after eight months of ageing. The SO_2 concentration at bottling was 30 mg/L. Copper was added at a concentration 0.2 mg/L.

Figure 4

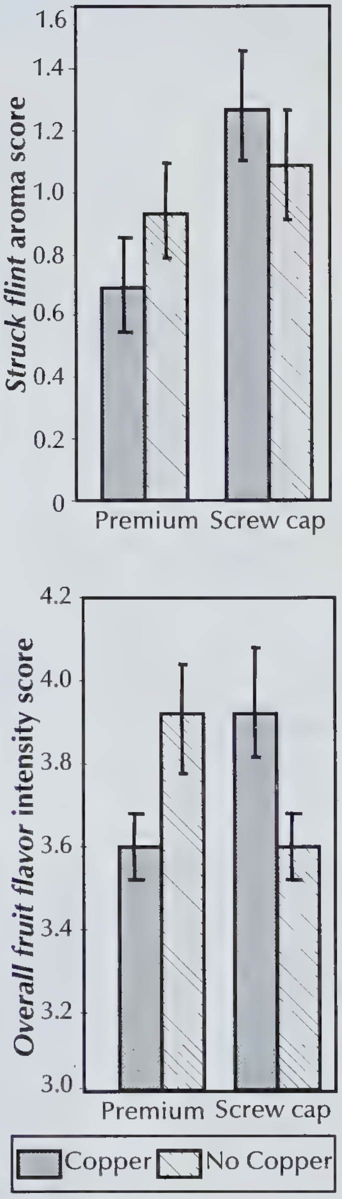

FIGURE 4: Effect of copper addition and closure type on selected sensory attributes of Sauvignon Blanc wines after 13 months of ageing. Copper was added at a concentration of 0.2 mg/L.

significant loss of quality, controlled exposure of wine to oxygen during and after bottling operations also represents a powerful tool available to winemakers to control wine aroma characteristics and wine style.

Between the extremes of reduced and oxidized off-flavors lies a whole range of different combinations of several oxidation-related aroma compounds which can be achieved by means of correct oxygen management, contributing to the expression of cultivar, regional, and style differences.

Figure 1 shows a simplified representation of the potential of oxygen exposure to determine the aroma profile of wine after bottling. The diagram is based on data reported in the literature on the evolution of impact aroma compounds under different regimes of oxygen supply.[1,2,4,5,6,10,13] Therefore, it is merely a generic summary, and it should not be taken as a recipe for wine oxygen management. The diagram is intended to provide a general overview of the possibilities offered by oxygen management when it comes to modulation of wine aroma composition.

Starting from a young wine with the same aroma composition, different oxygen regimes will lead to the development of wines with different patterns of volatile components. In the case of high oxygen exposure (Figure 1, right panel), degradation of the components responsible for aromas of tropical fruit and passionfruit [such as 3-mercaptohexanol (3MH) and 3-mercaptohexanol acetate (3MHA)], and floral aromas (linalool) can be quite rapid, while most fruity fermentation esters decline at a rate that is not affected by oxygen availability.

At the same time, aroma compounds responsible for oxidized aroma, such as sotolon and aldehydes, accumulate at a higher rate, due to the involvement of oxygen in their formation reactions, while an increase in dimethyl sulfide (DMS) appears not to be affected by oxygen. At low concentrations, DMS enhances red berry aromas but contributes negatively at high concentrations.

Under conditions of high oxygen exposure, the young wine evolves towards an aroma profile where fruity aromas are progressively replaced by the increasing contribution of DMS, aldehydes (nutty, dried fruit aromas, but also bruised apples for aliphatic aldehydes), and sotolon (spicy, nutty), while the contribution of reductive compounds, such as hydrogen sulfide (H_2S) and methanethiol (MeSH) is negligible.

Further exposure to oxygen, coupled with the concomitant decline in

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esters due to chemical hydrolysis, results in a wine where the fruity aromas are largely lost, while the contribution of oxidized aromas from sotolon and aldehydes [particularly (*E*)-2-alkenals] become dominant.

Conversely, when exposure to oxygen is low (Figure 1, left panel), compounds responsible for tropical fruit aromas, such as 3MH and 3MHA, are better preserved, while the formation of oxidative compounds like sotolon and aldehydes is minimized. In this case, a large component of the fruity aromas of the young wine is preserved over a longer time, while an increase in compounds such as DMS can positively contribute to the overall complexity. However, low exposure to oxygen can eventually result in the excessive accumulation of reductive aroma compounds, such as MeSH, possibly determining reductive off-flavors.

It appears, therefore, that many key aroma compounds exhibit trends during ageing that are strongly dependent on oxygen exposure. The case of volatile sulfur compounds appears particularly interesting, in view of the fact that these compounds, although having similar reactivity, exhibit very different odor properties.

While H_2S and MeSH are characterized by unpleasant odors reminiscent of rotten egg and sewage, 3MH and 3MHA are characterized by pleasant tropical and passionfruit aromas, and are known to positively contribute to the aroma of many red and white wines.[12] Therefore, any attempt to preserve the latter, desirable thiol compounds by means of oxygen management may increase the risk of higher accumulation of the former, undesirable sulfur compounds.

Oxygen management and Sauvignon Blanc aroma

Sauvignon Blanc is one wine where sulfur compounds can be drivers for both defects and desirable qualities. This paradox represents, perhaps, one of the biggest challenges for winemakers, due to the fact that compounds such as 3MH and 3MHA, along with the other powerful varietal sulfur-containing odorant 4-mercapto-4-methyl-2-pentanone (4MMP), play a prominent role in the varietal aroma.

Reducing oxygen exposure of the wine improves the stability of these compounds. The increased loss of these compounds at high oxygen exposure appears to be linked to their reaction with quinones, which are oxidation products of polyphenolics and whose levels increase as oxygen exposure increases.[1]

This is one reason why the vast majority of Sauvignon Blanc wines in Australia and New Zealand are bottled under closures with low oxygen transfer rates (OTRs), mainly screw caps, and low oxygen at bottling is recommended.[2] However, these conditions can increase the risk of developing reductive aromas, as confirmed by several studies

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carried out at the Australian Wine Research Institute (AWRI).[7,14]

Due to the lack of a comprehensive understanding of the mechanisms determining accumulation of reductive aroma compounds during winemaking,[8] winemakers often resort to pre-bottling copper addition to remove the sulfur compounds responsible for reductive off-flavors at low oxygen exposures. However, because of similar chemical reactivities, thiols such as 3MH, 3MHA, and 4MMP can also be negatively affected, resulting in an overall loss of varietal character.

The results in Figure 2, obtained during a recent trial at AWRI, show that copper additions at bottling can severely reduce the concentration of 3MH in Sauvignon Blanc wines bottled with high free SO_2 (60 mg/l), while no effect was observed at a free SO_2 of 30 mg/l. After eight months of storage, even in the wines bottled with 30 mg/l of SO_2, a decrease in 3MH, 3MHA, and 4MMP was generally observed in copper-fined wines, which was in most cases larger than the decrease associated with the use of higher OTR closure (Figure 3).

Taken as a whole, these results, besides showing the existence of complex interactions between SO_2 concentrations and copper addition, highlight the fact that copper addition, although potentially useful in preventing reductive off-flavor, can have detrimental effects on the varietal aroma compounds of Sauvignon Blanc.

Moreover, the exact amount of copper to add depends on the specific requirements of individual wines and can therefore be difficult to estimate, potentially resulting in excessive residual copper.[3] Because copper is a very powerful oxidation catalyst, excessive copper addition can accelerate oxidation reactions, resulting in a higher risk of premature oxidation.

The data in Figure 3 show the effect of two different closures on the stability of the three thiols during the first eight months of storage. The closure type had virtually no effect on the wines without copper addition, whereas an increase in OTR became highly detrimental when copper was added at bottling. The pro-oxidant action of copper, combined with increased oxygen availability, is probably responsible for this effect, which confirms the risks associated with excessive residual copper.

Furthermore, sensory analysis of wines from this study after 13 months of cellaring highlighted the complexity of the interactions between oxygen availability and copper addition (Figure 4). Overall, lower OTRs resulted in wines that were rated slightly higher for the reductive aroma attribute "struck-flint." confirming previous observations regarding the association between screw cap and the propensity of wines to become reductive after bottling.[7]

Interestingly, in the current study, the OTR did not affect the rating of the intensity of fruitiness, indicating that there was no direct effect of oxygen alone on this attribute. However, wines stored under screw cap (low OTR) were found to have slightly higher overall fruit-flavor intensity when copper was added at bottling.

Surprisingly, copper addition at bottling had no statistically significant effect on the *struck-flint* attribute in any of the wines, with closure type alone appearing to determine the level of this negative aroma attribute (Figure 4). This observation appears to contrast with the well-established practice of adding copper to remove reductive off-flavors. It might be linked to complex interactions between different aroma compounds, as previously outlined in Figure 1. Alternatively, it could also reflect the low propensity of the wine used in these trials to become reductive and, therefore, make it difficult to identify differences.

In contrast to copper's apparent lack of effect on the *struck-flint* character, copper addition slightly reduced the overall fruit flavor intensity, which appears to be in agreement with the lower concentration of varietal thiols observed in these wines after eight months (Figure 2). At the same time, however, the *struck-flint*

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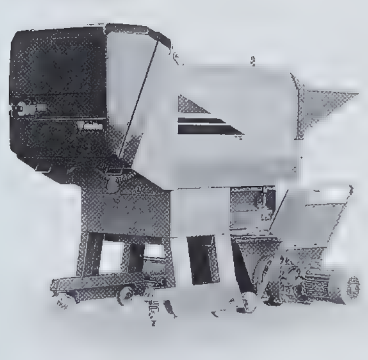
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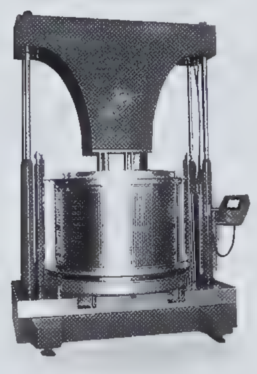
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aroma was rated lower in these wines compared to the corresponding samples under screw cap, which highlights again the array of aroma profiles and balances that can be achieved by means of oxygen management, particularly in conjunction with other common winemaking practices such as copper addition.

Conclusion and future perspectives

Understanding the reactivity of different aroma compounds towards oxygen under different conditions is necessary for informed decision-making when bottling and packaging. While in laboratory studies the key role of oxygen in determining the evolution of different wine aroma compounds during storage has been clearly demonstrated, the knowledge regarding the significance of these reactions under real winemaking conditions is still fragmented, in particular with regard to the use of oxygen management for the achievement of specific wine styles.

Research has shown that in the case of key Sauvignon Blanc aroma compounds, matrix composition plays a critical role in determining the reactivity of these compounds toward oxygen. The data presented in this study indicate that, when it comes to sulfur compounds, conditions favorable to the preservation of positive aromas can also promote development of negative compounds.

Our results also show that the widespread practice of copper addition at bottling to remove these potentially negative aromas might also reduce the levels of compounds responsible for varietal aromas. However, due to the lack of a suitable technology in the study presented here, neither oxygen concentration at bottling nor oxygen evolution during ageing were monitored, preventing a comprehensive interpretation of the data obtained.

Very recently, the in-bottle measurement of dissolved and headspace oxygen in wine has become possible, and this technology is currently being integrated into AWRI studies. In particular, we are currently investigating the effects of copper addition and antioxidant protection on oxygen evolution and chemical and sensory changes in Sauvignon Blanc wines.

While most studies on oxygen management have focused on white wine aroma, only a few researchers have studied the effects of bottling conditions or OTR in red wine.[9,11] Figure 1 indicates that, among the compounds that respond to differences in oxygen management, there are several compounds that are known to play a key role in the aroma of red wines.

One of the AWRI's current research objectives is to unravel the changes in key aroma compounds under different oxygen regimes (particularly OTR) in Shiraz wines, in relation to other key aroma compounds such as esters, which change over time in a non-oxygen-dependent way. ■

Acknowledgments

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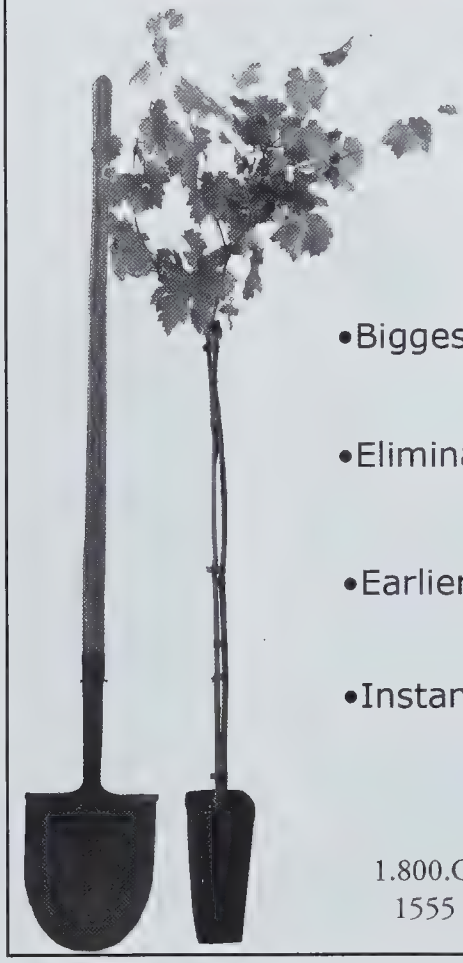

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VARIABLE VINE SPACING + MICRO-BLOCK IRRIGATION YIELD UNIFORM FRUIT QUALITY

BY Jim Caudill

Walk with Duff Bevill through the 20 acres of the Comstock Vineyard in Dry Creek Valley and you will find things familiar, orderly, and just what you would expect from a top vineyard farmed for flavors, with grapes that head directly into Sonoma County (California) wines selling at ultra-premium prices.

Look closer, though, and listen as Duff describes an evolution in vineyard design. Here, technology is married with years of experience resulting in blocks that are farmed not to the "weakest link" but with variable vine spacing in every row, with micro-irrigation runs set to match, stopping and starting in staggered patterns.

Bevill Vineyard Management Partner and Supervisor Matt Vogensen, head of vineyard development with more than 500 acres developed on his watch, says, "this provides a level of fine-tuning and farming flexibility that ensures a vineyard in balance, producing at an optimal level that keeps winemakers smiling," giving true meaning to the Bevill credo "Vineyards of Distinction."

"Within nearly all vineyards that we manage," explains Bevill, "there are exceptional blocks, vines and rows that exhibit distinctive, enhanced quality. This is what we call a Signature Block, a vineyard of distinction. We believe that highlighting these areas will provide added value for all grapes grown at this vineyard."

Since 1998, Bevill has converted more than a dozen vineyards using this emerging design philosophy. Comstock Vineyard (20 acres on the Dry Creek Valley floor), which features Cabernet Sauvignon, Zinfandel, and Sauvignon Blanc, began converting almost five acres of Zinfandel, and almost nine acres of Sauvignon Blanc five years ago.

Wyatt Irrigation Supply, Ray Carlson & Associates, and Farmecology Labs and Field Service are among the supporting partners working with Bevill.

Soil vigor analysis

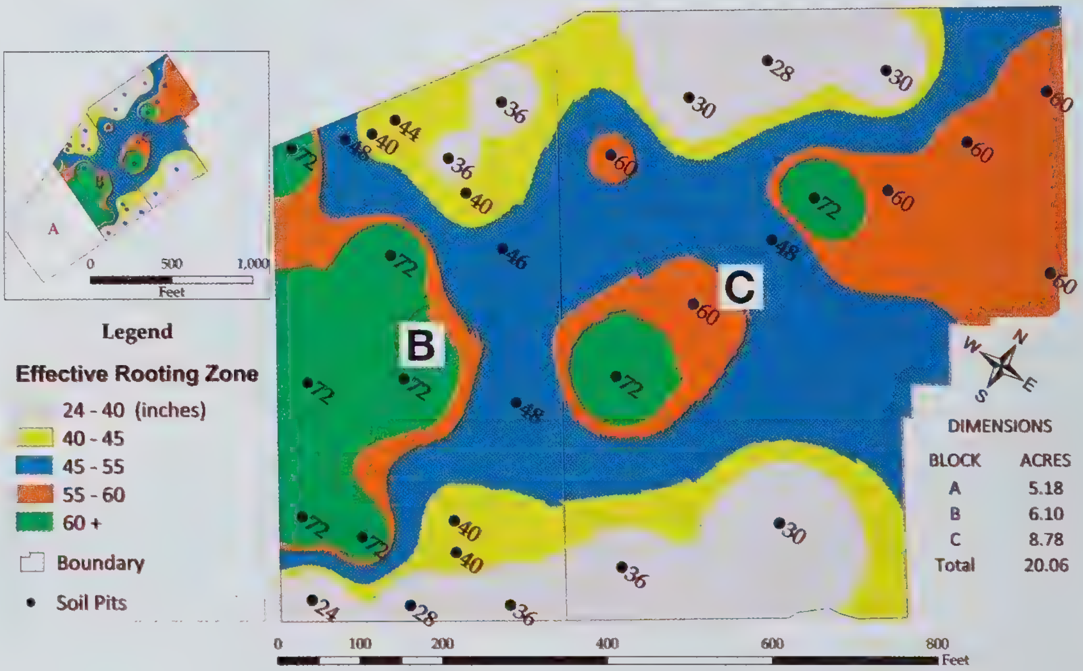
To illustrate the approach, three blocks of Cabernet Sauvignon (5.33 acres), planted in 1998 have not yet been replanted. Spacing is 9 feet x 6 feet, with drip emitter spacing at a uniform 36 inches. On a vineyard map, the blocks are more or less rectangular, orderly.

In the younger blocks planted to Sauvignon Blanc, there are 7-foot wide tractor rows and vine spacing is 4 feet, 5 feet, or 6 feet, with emitter spacing at 30 inches, 36 inches, or 48 inches according to soil vigor and the need of the vines, following the lead of the variable vine spacing.

The vineyard map shows a block boundary that undulates and moves through the vineyard like a flowing stream, mapped utilizing Global Positioning System (GPS), Geographic Information Systems (GIS), and extensive soil analysis which ranks soil vigor on a 10-point scale, augmented by an analysis of effective root zones.

The soil vigor ranking developed by Farmecoloy and Bevill Vineyard Management starts with tight, restrictive soil or sand and gravel as #1, with #5 being mixed soils of medium vigor potential, and #10 being generous Yolo loam requiring little if any irrigation once vines are established. Soil nutritional analysis is another component considered in the evaluation.

Rootstocks include 110-R, used in thin, rockier soils with 4-foot spacing. This vigorous rootstock and close spac-



Map shows GPS-located soil pits which were analyzed by Farmecology from both lab and field expertise to create many GIS map layers (effective root zone shown here) of information which ultimately form a vigor-potential map. The vigor regions are used to layout "micro irrigation" sub blocks with varied vine spacing and rootstocks, retaining same tractor row spacing for efficient management. Map compiled by Ray Carlson & Associates, Santa Rosa, CA.

ing helps to achieve the proper vine growth and balance, notes Vogensen. A moderate vigor rootstock, 101-14, is planted in other blocks more appropriate to the soils found there.

Sauvignon Blanc clone 01 was selected for the new blocks. "This clone meets the needs of differing winemaking styles depending on how it is farmed and when it is harvested," explains Vogensen. The Zinfandel clone selected is known as Bevill/Mazzoni, a selection used on Bevill-managed ranches for 20 years. "It offers high wine quality and is very reliable," adds Vogensen.

Multiple irrigation blocks

In a typical vineyard block, the irrigation array might have one or two gate valves covering a large area uniformly. At Comstock, the valves are controlled by electric solenoids, operating off a programmable clock. "Irrigation could be set for 30 minutes three times per day, or 10 hours once per week, offering great versatility," says Vogensen.

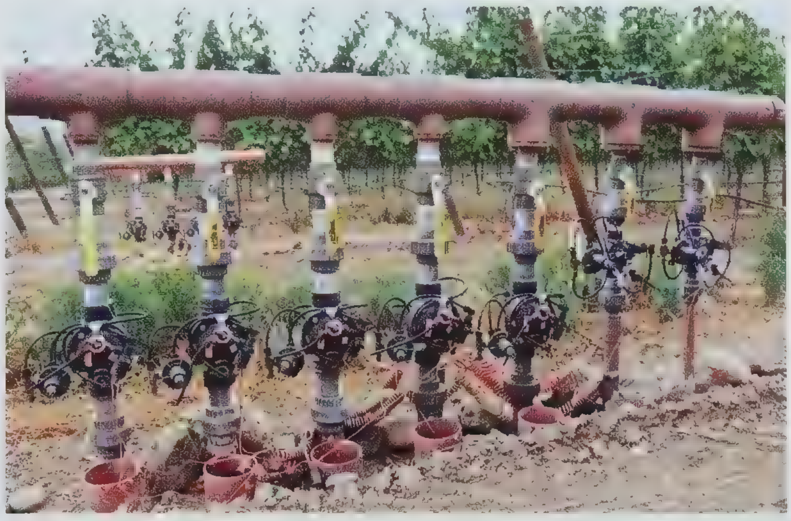
The Cabernet Sauvignon blocks have three irrigation zones, Zinfandel blocks (planted in 2005) have four zones, while an older Zinfandel block D (0.84 acre) has one zone. Sauvignon Blanc (planted in 2003) has four zones, while newer Sauvignon Blanc (planted in 2005) has three zones.

"This gives us the flexibility to water each vine block, in each variety, with the appropriate amount of time and gallons of water based on need."

While GPS and other technologies have been routinely used in vineyard planning and development by many vineyard management companies, the Bevill approach is unusual and innovative for its varied spacing within vine rows, and the ability to control irrigation in mini-blocks within larger blocks. In an age where sustainability is a duty and not a virtue, the obvious benefits of gaining efficiency over water usage is an added plus, putting this evermore precious resource to work only where and when needed.

Varied vine spacing requires precision irrigation to encourage uniform healthy vines and ultimately, greater control of variables such as ripening, crop load, and water usage.

In a micro-irrigation approach where soil vigor is carefully mapped using GIS, small vine zones may mean more than one break point in the irrigation line in a single vine row. Photos by Jim Caudill.



Manifold with electric control valves for irrigation of seven blocks. There is another manifold with five electric control valves to irrigate five blocks. Three control valves are remotely placed throughout the Cabernet Sauvignon block.

Pump sizes, when comparing the older design to the new, are essentially the same, although Bevill is replacing old pumps with variable speed pumps that deliver water even more precisely while using the optimal level of electricity, reducing demand, costs, and greenhouse gasses from electricity production.

The innovative design process, whether in retro-fitting vineyards or developing new vineyards, relies heavily on GPS/GIS for soil analysis, mapping and layout, irrigation maps, and accurate mapping based on soil vigor potential. GPS/GIS is relied on to guide precise vineyard installation, including soil preparation, drainage piping, irrigation pipe installation, variable-spaced vine planting, and trellis orientation and installation.

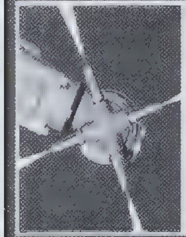
"These are fairly standard development approaches," notes Bevill. "But the comprehensive analysis at the beginning stages when planning the vineyard makes all the difference. Knowing it and doing it are often two different things."

Variable spacing improves consistency

Dry Creek Vineyards contracts for the Sauvignon Blanc and Cabernet Sauvignon from Comstock Vineyard. "It is a vineyard that has definitely improved," notes Lisa Bishop Forbes (Dry Creek winemaker), "with both age and the modified water regime and variable vineyard spacing.

"The Sauvignon Blanc, in particular, has benefitted from variable spacing to manage vigor and the water available in the vineyard. This approach allows for consistent fruit flavors and quality, making my job a lot easier."

Sauvignon Blanc, planted in 2003 has produced, on average, 6.5 to 7 tons per acre. Zinfandel, planted in 2005, yielded 3.65 tons per acre in 2007 and more than five tons per acre in 2008. Comstock Cabernet Sauvignon, which



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has not been replanted to the new variable design, has varied from three to six tons per acre.

Bevill farms all of Dry Creek's vineyards, and Forbes notes that the variable spacing approach is also used at Dry Creek's Endeavour Vineyard (Lytton Springs area), planted on rolling hillsides. "The water availability and vigor of the soil in the Cabernet blocks planted at Endeavour vary quite a bit," she adds. "Winemaking is much easier when the fruit is more consistent throughout the vineyard."

There is a welcomed sustainable benefit to Bevill's approach, notes Forbes. "We have forward-thinking people on our side, with the same goals. We all want the best wine possible, and that comes from the best fruit, which Duff gives us."

Bevill farms 1,100 acres and provides fruit for about 40 wineries in Sonoma and Napa counties, all competing in the higher tiers of the market, and including such notables as Merry Edwards, Dry Creek Vineyards, Chateau St. Jean, Sonoma-Cutrer, and Nickel & Nickel.

Comprehensive soil analysis achieves more productive vineyard

Nearly every year since 1975, Bevill's company has been redeveloping or planting vineyards, a sort of living laboratory where the learning never stops and refinements are seen as necessary, ongoing evolutions based on continuing insights and education. In the past decade, an average of three vineyards each year have been shaped and reshaped into this new vision of precision farming.

If a vineyard soil analysis plan had 36 five-foot deep soil pits spaced 100 feet apart, five years ago, today's planning might go further.

"If we looked at that example in hindsight and found an area where one pit was a soil of one texture, a loam for example, and another was gravel, we might look closer and dig additional pits in between that area at 50 feet, even 25 feet," explains Bevill, "to understand, with more certainty, the soil profile and how varied it might be in that area, where the exact transition from loam to gravel occurs, allowing the natural contour lines of the block to be revealed.

"We would consider all the variables available to us before planting, including appropriate rootstocks, clones, vine spacing, and how to plan irrigation most effectively."

Based on this comprehensive analysis, vine spacing in areas of heavy rock might be three feet; a sandy loam would be planned for four feet and rich soils spaced at six feet. Soil vigor is rated on a 10-point scale (4 being less vigorous, 10 having the most potential for vigorous growth). "Soil quality is something everyone wants to evaluate, but it is not enough by itself," he adds.

Using this approach, any additional costs are related mostly to vine density, with modest costs for additional materials related to irrigations plans, such as additional valves. But these added costs disappear based on vineyard

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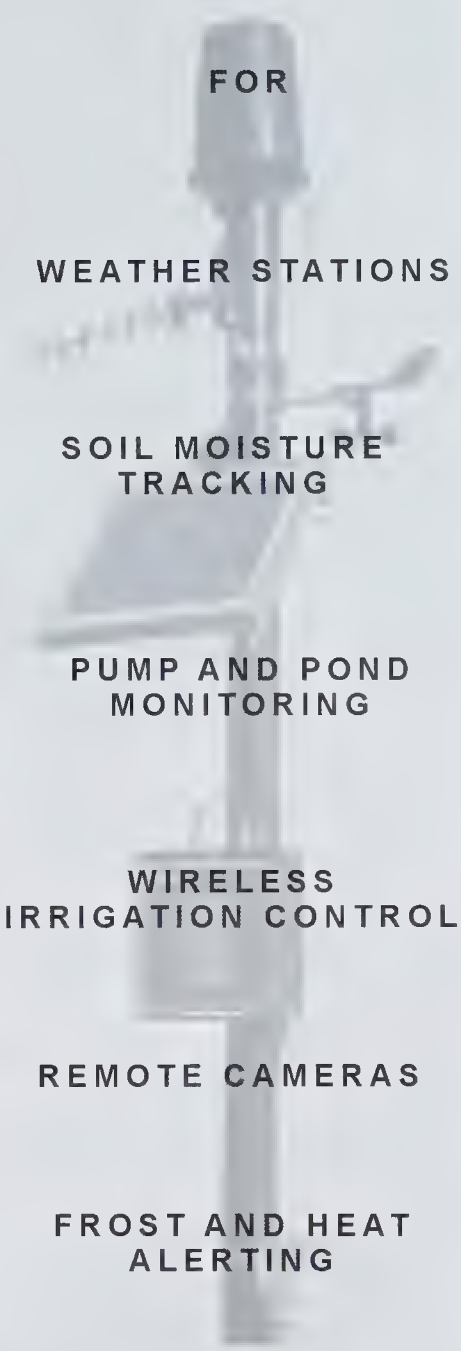

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health, which produces a marketable, usable crop earlier in its lifecycle and remains healthier and balanced, with less overall needs for inputs, over an extended period of time.

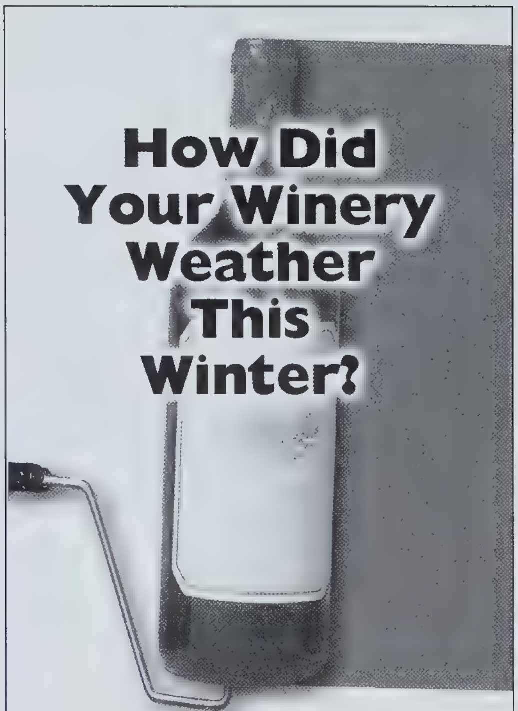
Bevill acknowledges that the greater, earlier production is at least partly the result of planting more vines per acre.

"The higher density design tends to produce more excellent fruit earlier than with designs more typical for vineyards planted in the 1960s, 1970s, and 1980s," explains Bevill. "The crop load per vine may remain relatively constant, but increasing from 450 vines per acre in older designs to 1,200 vines or more can make a dramatic production difference in the early years of a vineyard. For example, 450 vines at 5 lbs per vine will yield 2,250 lbs per acre compared to 1,200 vines with the same vine load yielding an additional 4,000 lbs per acre."

As a vineyard matures, Bevill notes the added value of variable spacing begins to play itself out. "The per-vine production within each sub-block will reflect the potential of that specific micro site. A three-foot vine spacing decision reflects a low vigor potential in the soil analysis, and each vine is expected to produce relatively less. It is also expected, though, that each vine will, in fact, fill its space and canopy.

"The same is true with a wider spacing choice in an adjoining block. It, too, is expected that vines will fill their space and canopy, but the space is larger. We do not want to be faced with a small vine, and the need to try to encourage it to become more vigorous, nor do we want a large vine that needs to be tamed.

"Vine balance is the goal, and occurs more consistently, year after year, with more reliable quality and production levels, with our variable spacing designs because the pre-plant analysis of the blocks-within-blocks design pre-



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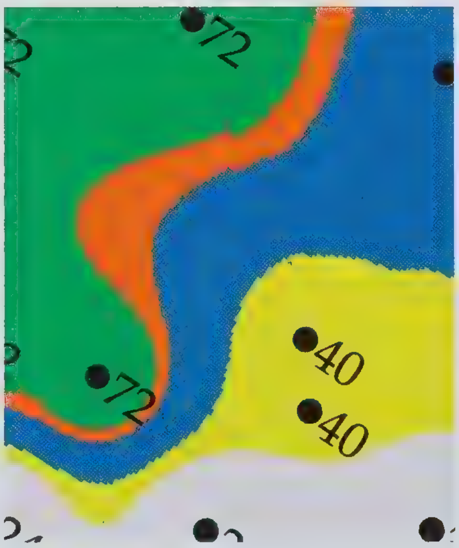

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determines the ultimate size of the individual mature vine."

Bevill notes that for a mature vineyard, the ultimate goal is "to have the entire trellis of each row filled, with no gaps or spaces on the fruiting wire, with quality fruit that is in balance with the canopy regardless of soil type or soil transitions found throughout any given vine row. Our variable spacing design, and vineyard management approach that complements it, helps meet all quality and production goals."

Extra care is needed when pruning, to allow for the differing needs of less vigorous vines. "We have made it easier to be a skilled employee," notes Vogensen, who helps manage 125 Bevill employees, including foremen with more than two decades of service within the company. "With the level of fine-tuning and control available in the vineyard, good decisions come naturally." ■

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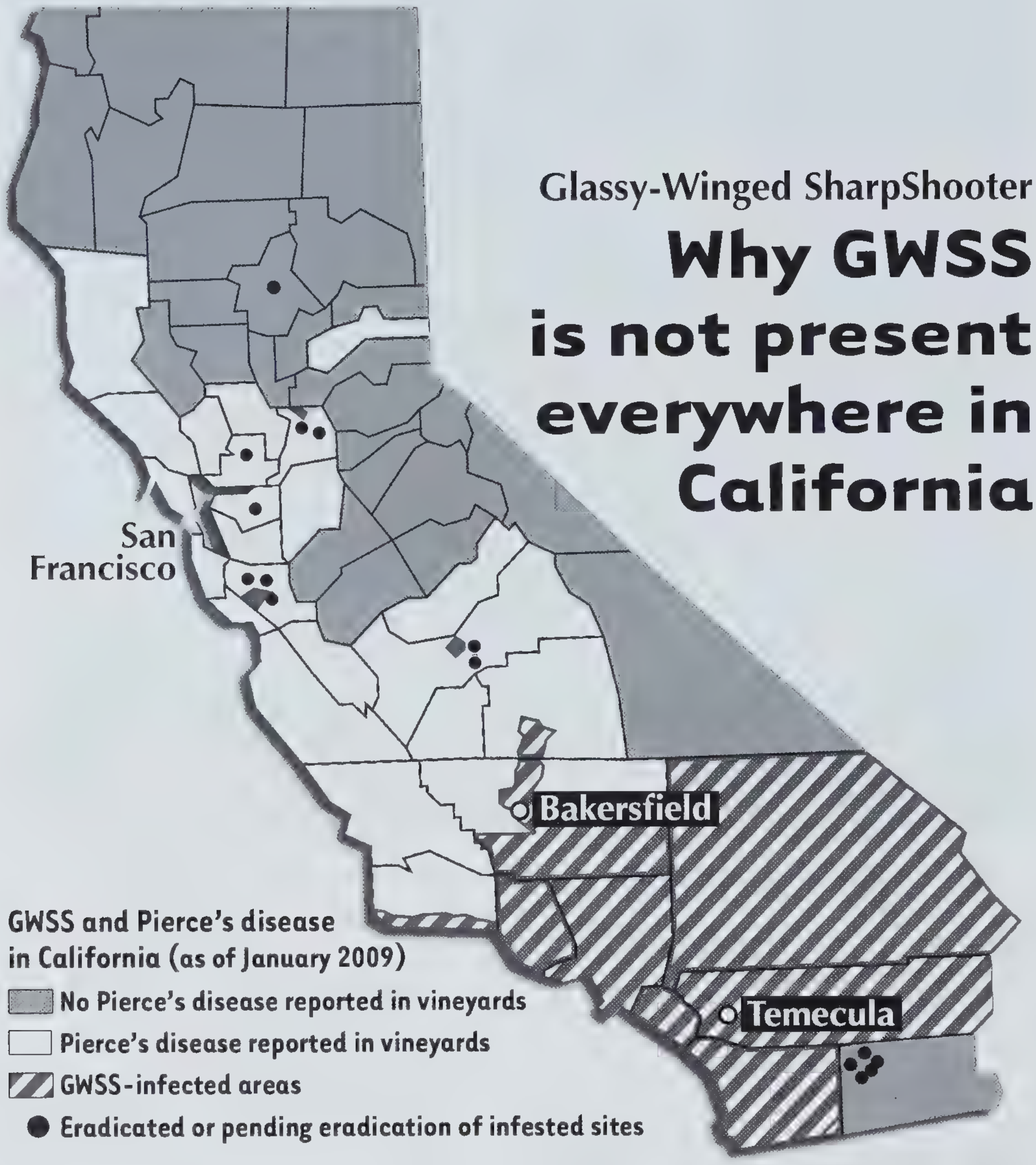
Glassy-Winged SharpShooter

Why GWSS is not present everywhere in California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GWSS and Pierce's disease in California (as of January 2009)
▨ No Pierce's disease reported in vineyards
☐ Pierce's disease reported in vineyards
▨ GWSS-infected areas
● Eradicated or pending eradication of infested sites

BY ***PWV* staff**

Ten years ago, the glassy-winged sharpshooter (GWSS) was poised to sweep across California, spreading Pierce's disease (PD) and wiping out or at least severely crippling much of the winegrape production in the state. What happened?

"The answer is simple," says Bob Wynn (California Department of Food & Agriculture). "A $20 million per year program has managed to control the spread of GWSS, eradicate spot infestations as they are discovered, and contain it to the southern part of the state, for now."

As a result of that program, if you are a winegrape grower north of a line that runs roughly from San Bernardino County across the southern part of Kern County (with a strip running up through Tulare), then down to Ventura County and across the southern edge of Santa Barbara County, you should not have any GWSS in your vineyards.

GWSS was discovered in Southern California in the late 1990s, and in 2001 the CDFA conducted a statewide survey to determine just how far GWSS had spread. The survey found that GWSS were present in eight Southern California counties. It also determined that the infestation of GWSS was too widespread to be eradicated, but that it would be possible to temporarily contain it and limit further spread until a permanent solution could be found.

"We all knew that limiting the spread of GWSS would be an expensive endeavor, but it was meant only to be a temporary measure," says Wynn.

Also in 2001, California's forward-thinking winegrape growers voted to establish an assessment to pay for research to seek a permanent solution to

Vote YES on PD/GWSS Winegrape Assessment

Very soon winegrape growers across California will be receiving ballots to extend a winegrape assessment for five years and continue 10 years of comprehensive work to address the threat of Pierce's disease (PD) and the Glassy-Winged Sharpshooter (GWSS).

Few issues pose as great a threat to the wine industry as PD (which is fatal to grapevines) combined with the powerful GWSS vector (which transmits *Xyllela fastidiosa* bacterium into grapevines). Ironically, the model approach of growers, vintners, researchers, and government working together to contain that threat while working toward a cure for PD has been so successful that the industry has become complacent about the very real threat that continues to loom. Make no mistake, uncontrolled, PD and GWSS are a deadly combination that has wiped out vineyards.

Significant progress has already been achieved. The program has funded hundreds of research projects directly benefitting the wine industry, including these promising field trials underway in 2010:

- New PD-resistant grape varieties resulting from traditional breeding;
- PD disruption in grape varieties resulting from genetic modification;
- PD-controlling rootstocks that disrupt the disease in commercial scion varieties;
- Bacterial endophytes that colonize a vine's water-conducting tissue and disrupt PD; and
- External sprays of compounds/molecules that disrupt PD in existing vines.

In this present recession, an eye to costs is essential. However, we also have to be responsible. This unique industry/government partnership has leveraged every penny invested by growers tenfold to enable the wine industry to coexist with both PD and GWSS. Your **yes** vote will not only continue this important venture, but also expand its scope to tackle emerging pests and diseases.

I urge all winegrape growers to vote **yes** in May on continuing the PD/GWSS winegrape assessment.

Don Neel, publisher

Pierce's disease. They established the PD/GWSS Board of 14 winegrape growers and grower-vintners to direct funding of that research. But even as scientists and researchers move toward a solution, containment of GWSS remains key to the survival of California's winegrape industry.

A principal part of the containment program has been the U.S. Department of Agriculture's (USDA) area-wide control programs set up in various regions across Southern California. Area-wide programs coordinate insecticidal treatments in commercial ag commodities — primarily citrus blocks — and urban areas, along with the release of biological control agents in GWSS-infested regions. Visual surveys and trapping in these areas provide information on sharpshooter population numbers and serve as indicators of developing "hot spots" where treatments may be needed.

"The overall purpose of the area-wide control programs is to suppress GWSS populations in order to reduce the incidence of Pierce's disease and the movement of this key vector," says Beth Stone-Smith (GWSS Program Director for the USDA). "In an area like Tulare County, we are decreasing the chance of the natural spread of GWSS northward into un-infested areas. The program also aids citrus growers in complying with the state regulation of shipping bulk citrus GWSS-free, thus preventing the artificial spread as well."

Has it worked? In Tulare County, citrus groves along the eastern side of the Central Valley have been treated since 2004. Thanks to these efforts there has been little or no spread of GWSS toward the west where many vineyards exist. Just a little to the north, trapping efforts indicate the continued absence of GWSS throughout the Fresno County citrus belt.

"When the area-wide program first started during 2001 in the General Beale area in Kern County, you could walk out in a citrus grove and GWSS were everywhere," recalls Stone-Smith. "At times there were so many GWSS that sticky traps were full before they could even be changed out on the weekly schedule."

During the first year of the program in 2001 there were more than 147,000 GWSS trapped in the General Beale Project area alone — that is 13,000 acres of multiple commodities, 3,600 acres of that being citrus. This was in spite of the fact that foliar treatments were being applied during the season. Through the area-wide control program, 3,600 acres of citrus (and some windbreaks) were treated and by 2002 GWSS populations had dropped to near undetectable levels.

"We went from hundreds per trap per week to zero per trap per week," recalls Stone-Smith. "This also underscored to us the importance of applying treatments early in the season."

Between 2001 and 2008, the cost of the USDA's program totaled $26.64

Continued on page 57

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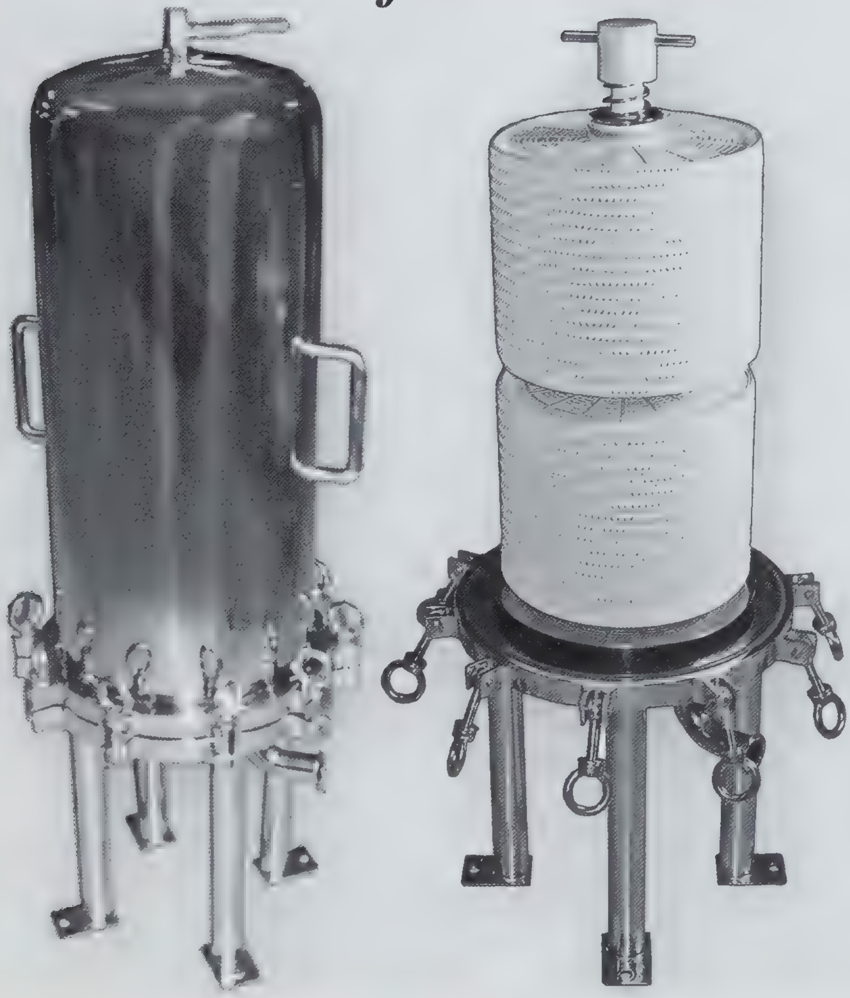

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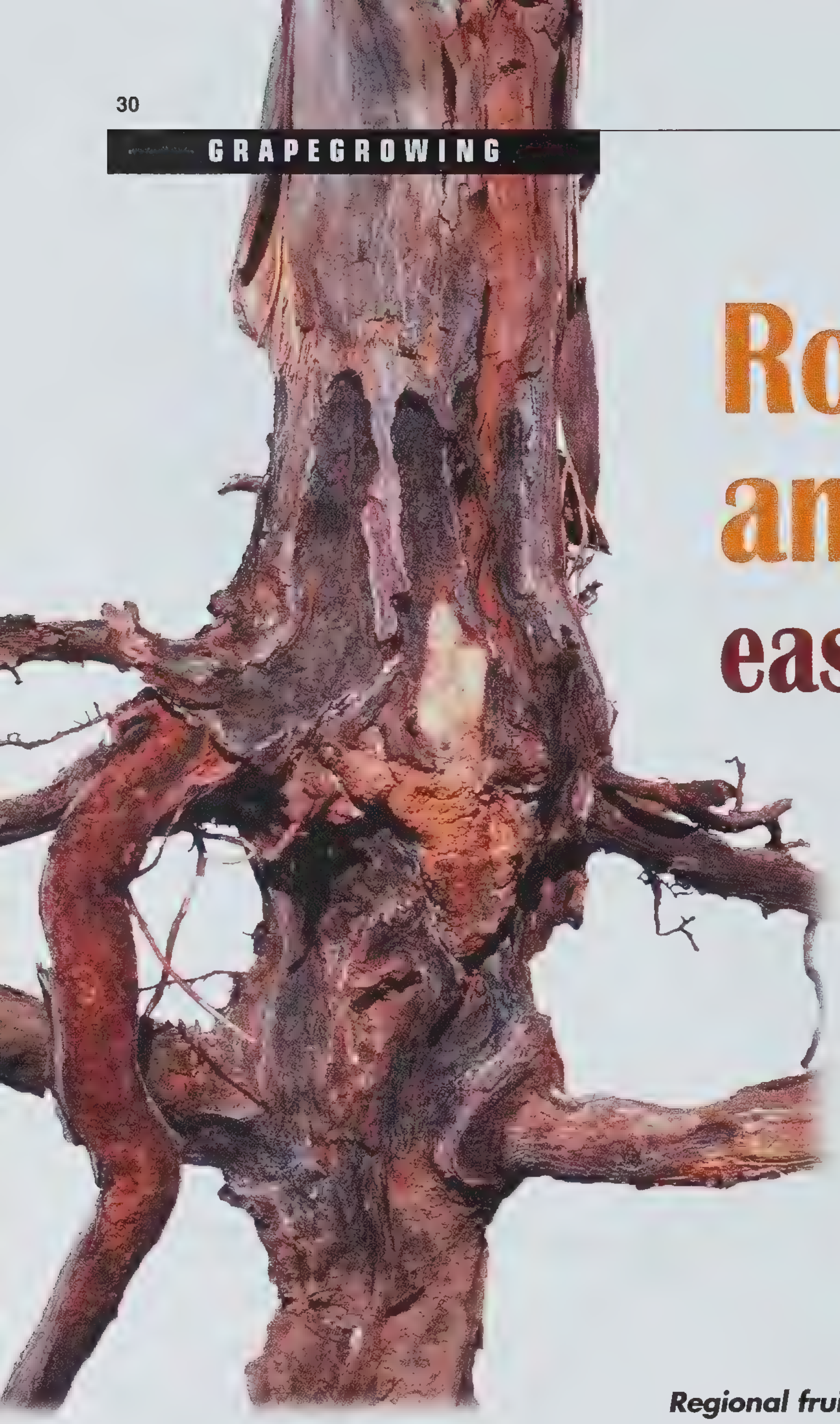
Rootstock use and evaluation in eastern North America



Grape root borer damage to grape trunk and roots — *Vitacea polistiformis* (Harris) larvae. Photo by James Solomon, USDA Forest Service, Bugwood.org.

KEY POINTS:

Management of soil-borne pests and diseases is the chief reason rootstocks are used in eastern North America.

High diversity of fruiting varieties and their requirements for phylloxera protection drives decisions for rootstock use across the region.

Diverse and heterogeneous vineyard sites and climates impact rootstock variety choice.

**BY Peter Cousins, Grape Rootstock Breeder and Geneticist,
USDA ARS, Grape Genetics Research Unit,
NY State Agricultural Experiment Station, Cornell University,
Geneva, NY**

Viticulture in eastern North America encompasses a vast area with many distinct regions, climates, key pests and diseases, and other diversifying factors. For example, hot, high-rainfall areas at low elevations in the southeastern U.S., such as in Mississippi and Alabama, have a different variety composition than continental climates, such as in Missouri.

Viticulture on the eastern end of Long Island is quite different from that in the Finger Lakes region of central New York State, in climate, soil, and variety composition. The very definition of eastern North America is nebulous, since semi-arid parts of the southern U.S., such as regions of Texas, may have more in common with central California or eastern Washington, which is reflected in scion variety choice and management practices.

Regional fruiting varieties

Phylloxera is native to eastern North America and protection against phylloxera is the principal reason that rootstocks are used. However, unlike in many other phylloxera-prone regions, the fruiting varieties grown in the region provide diversity with regard to phylloxera management. This is in contrast to other viticultural regions, where *Vitis vinifera* varieties subject to phylloxera damage are grown exclusively or nearly so — Napa Valley, for example.

There are four chief categories of fruiting varieties in eastern North America, each of which represents a distinct approach to rootstock utilization: *V. vinifera*, hybrid-direct producers, American hybrids, and muscadines.

Grape root borer larva. Photo from Clemson University/USDA cooperative extension, www.Bugwood.org.

Vitis vinifera

Vitis vinifera varieties are grown across eastern North America, mostly in an arc west and north of the zone of heaviest Pierce's disease (PD) pressure and at high elevations within the PD zone.

The northern limit of *V. vinifera* cultivation is largely determined by the willingness of growers to bury vines in the winter; extensive plantings are in New

York, Texas, Pennsylvania, Virginia, Ohio, Michigan, Missouri, North Carolina, and Arkansas. Across the region, recognizing that phylloxera are frequently abundant, *V. vinifera* typically is grafted to rootstocks for phylloxera protection.

Hybrid-direct producers

Hybrid-direct producers, also known as French-American hybrids or colloquially as just hybrids, are interspecific hybrids of *V. vinifera* with other grape species. The first hybrid-direct producers were developed in Europe in an attempt to combine the desirable fruit composition of *V. vinifera* with the phylloxera protection provided by North American species, in order to re-enable direct production of wine on ungrafted vines in European viticulture that had become infested with phylloxera.

Hybrid-direct producers are mostly free of "foxy" flavors and aromas in their fruit, although they may express other flavors and aromas that distinguish them from *V. vinifera*. Notable hybrid-direct producers in cultivation include Chambourcin, Baco noir, Marechal Foch, Seyval blanc, Aurore, and DeChaunac.

Some hybrid-direct producers are recognized as having substantial resistance to foliar diseases, especially powdery mildew and downy mildew, and enhanced cold hardiness relative to *V. vinifera*. Hybrid-direct producers are extensively cultivated in eastern North America, especially outside the PD zone.

New varieties continue to be developed, with the goal of producing varieties with more desirable fruit composition than older hybrid-direct producers and with better disease resistance and cold hardiness than *V. vinifera*. Recent releases of interspecific hybrids include: Chardonel, Noiret, Corot Noir, Traminette, and Valvin Muscat.

Rootstocks are used with hybrid-direct producers, although the vast majority of vines are cultivated on their own roots since many varieties in this group are not as susceptible to phylloxera as *V. vinifera* varieties are.

The protection against phylloxera and other soil-borne pests and diseases provided by rootstocks and the value of increased vine size is recognized by grape growers.

However, the added cost of purchasing and managing grafted vines, along with a lack of evaluation information about which rootstock is suitable for a particular variety and location, reduce the adoption of rootstock use in hybrid-direct producers. Several scion-varieties routinely are offered for sale as both own-rooted and grafted vines and there is a trend toward increased availability of grafted vines and use of rootstocks.

For example, Seyval blanc is routinely planted as grafted vines to

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increase weak vigor and Vidal blanc, is planted on rootstock to provide protection against ringspot decline, a problem in own-rooted Vidal blanc vines. Many replacement vines planted into established vineyards are grafted.

American hybrids

American hybrids are interspecific hybrids among *V. vinifera* and North American wild species that were first developed in North America for adaptation to particular local pests, diseases, and climates. American hybrids are usually grown on their own roots; some have even been used at times as rootstocks.

The class includes the distinctively aromatic "foxy" fruited varieties such as Concord, Niagara, Catawba, Elvira, and Delaware. These varieties, often called native, "labrusca," or "labruscana," have the wild grape species *V. labrusca* in their parentage, but they are not pure *V. labrusca*.

Norton (also called Cynthiana) and Black Spanish (Lenoir, Jacquez), whose berries are not "foxy," also are considered American hybrids, showing characteristics of hybridization of *V. aestivalis* with *V. vinifera*. Elvira (500 acres in New York) has mostly *V. Riparia* and *V. labrusca* in its background.

Concord and Niagara are the dominant varieties in this category. They are nearly always cultivated on their own roots, although the value of rootstocks in increasing vine size, improving water status, and providing protection against phylloxera in Concord has been shown repeatedly.[1,2,19]

The relatively low value per ton of Concord and Niagara grapes provides an incentive to reduce production costs, which contributes to the relatively low utilization of rootstocks in Concord and Niagara production due to the higher establishment and management costs associated with grafted vines. K. Striegler and J. Morris demonstrated the yield benefit of grafting Norton.[24] Many recent Niagara plantings have been grafted, recognized as an advantage when replanting directly into existing vineyards.

Muscadines

Muscadine grapes (*Vitis rotundifolia*), grown extensively but exclusively in the southeastern U.S., are not grafted in commercial production. They are highly resistant to phylloxera and to many nematode species, but are not resistant as a species to grape root borer.

Pest and disease control issues

While phylloxera is the chief reason that rootstocks are used, other soil-borne pests and diseases are important in eastern North America and their management with rootstocks is a consideration when rootstock variety is chosen. Important pests and diseases of particular note for the region include several species of nematodes, diseases associated

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Nematodes and viruses

Dagger nematodes of the *Xiphinema americanum* species complex are found in many vineyards across eastern North America. These nematodes may feed on grapevine roots and on the roots of many other plant species, including common vineyard weeds and other crop plants.

Xiphinema americanum is different from the related *X. index* dagger nematode (vector of grapevine fanleaf virus GFLV) in its broad host range. *Xiphinema americanum* nematodes are vectors of tomato ringspot virus, tobacco ringspot virus, and peach rosette mosaic virus (PRMV), which are associated with ringspot decline and peach rosette mosaic virus decline respectively.

Few vineyard studies with grafted vines have been conducted to determine the impact of *Xiphinema americanum* directly, despite the nematodes' wide distribution in vineyards. Growers in New York and elsewhere anecdotally report the choice of 3309C as a rootstock to provide protection against tomato ringspot decline.

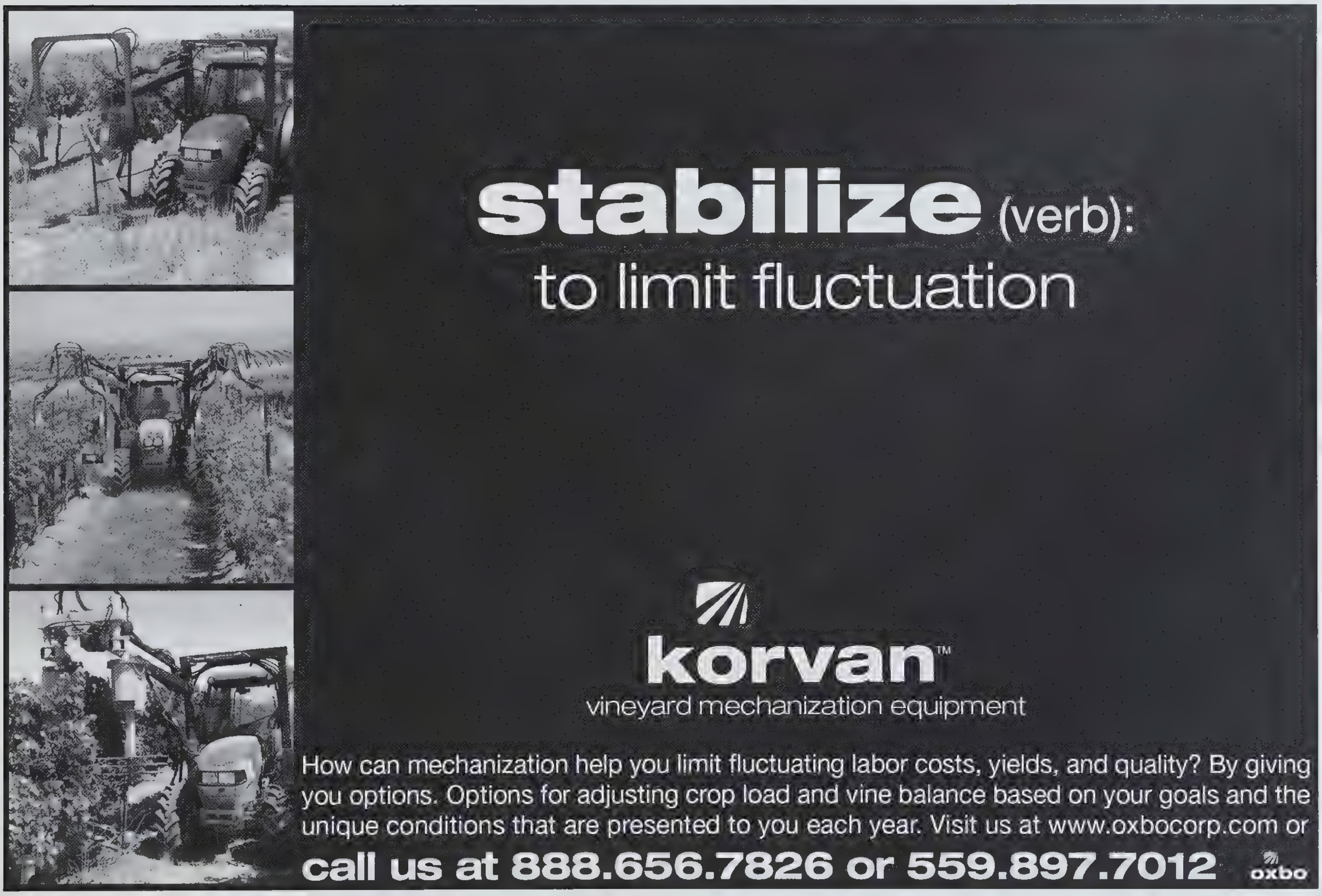
L. W. Stobbs et al. found Sonona, SO4, 5BB, 3309C, and 44-53M prevented the movement of tomato ringspot virus into DeChaunac scions and recommended Sonona and 3309C as these increased yield and fruit quality while also preventing virus infection of the scions.[21] Despite the increase in dagger nematode counts on all rootstock varieties over the course of the experiment, grafted vines were superior in yield and fruit quality.

Two studies of own-rooted vines in PRMV-susceptible vineyards evaluated the difference in infection rate among varieties.[16,17] Delaware was recommended as a rootstock due to its complete freedom from infection in the earlier study.[16] However, Delaware is a relatively weak variety and poorly suited for use as a rootstock.

D. C. Ramsdell et al. found that 1616C was the least infected of the rootstock varieties studied, although 4.5% of 1616C vines were infected.[17] The most infected rootstock was Teleki 5A, with 50% of vines infected.

No differences in nematode population levels were found among the varieties tested, suggesting that the primary cause of differences in infection was the variety's response to the virus, not its response to the nematode. Although grafted vines were not examined, D. C. Ramsdell et al. recommended 1616C as a rootstock for PRMV-susceptible varieties, such as Concord and Niagara.[17]

Evaluation of grafted vines and rootstocks to determine the value of particular rootstock/scion combinations for improving vine yield and longevity is needed. Even closely related scion and rootstock varieties



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may have very different vineyard performance in nematode/virus locations.

Root-knot nematodes (*Meloidogyne* species) can be important vineyard pests in the region. *Meloidogyne nataliei* was reported first from Concord vines in Michigan and was also found on nearby Niagara vines.[8] Its present range is limited to Michigan vineyards and wild grapevines,[4] but it is apparently well-adapted to temperate zone vineyards,[4,7] in contrast to other *Meloidogyne* species (*M. arenaria* and *M. incognita* in particular) which are important in warm-to-hot viticulture regions including the San Joaquin Valley of California.

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The host range of *M. nataliei* includes several *Vitis* species. Differences in reproduction were observed among varieties tested, with Riparia Gloire and St. George supporting much less nematode population growth than did 5BB. Root-knot nematodes were sufficiently important in Florida to warrant the breeding and introduction of two root-knot nematode resistant rootstocks, Tampa[12] and Florilush;[13] Florilush is reported as resistant or tolerant to the feeding of other species of nematodes.[13]

Crown gall

Crown gall, caused by the endophytic bacterium *Agrobacterium vitis*, is a serious disease, especially where winter injury occurs regularly. Rootstock resistance to crown gall has been found; however, the role of rootstocks in crown gall disease management is not fully determined.[5] The strain of the pathogen and resistance responses of rootstock and scion appear to interact and thus far, no specific rootstock can be recommended for crown gall management.

Grape root borer

The grape root borer (*Vitacea polistiformis*) is a clear-wing moth, the larvae of which feed on grapevine roots, causing severe damage and even vine death. Found primarily in the southeastern U.S., its range extends from Florida to southern Michigan, Ohio, Pennsylvania, and Kansas.[26]

A few studies have shown potentially useful differences among rootstocks in providing protection against grape root borer damage.[26,27] When bunch grape and muscadine varieties were evaluated for resistance to grape root borer,[25] there was a range of responses among the muscadines (although most were very susceptible to damage).

Effective resistance to grape root borer within muscadines could be an impetus to graft them. The best bunch grape rootstocks were superior in resistance to muscadines,[25] although no variety was completely resistant to grape root borer.

Florilush was compared to two other rootstocks used in Florida — Tampa and Dog Ridge.[13] While 75% of

Tampa and Dog Ridge vines were killed by grape root borer, only 25% of Florilush vines were killed. Although cultural practices (mounding, pesticides) currently are recommended for grape root borer management, there is great potential in further evaluation, selection, and breeding for grape root borer resistance.

Rootstocks and cultural practices

Cultural practices that influence rootstock choice and utilization (especially in contrast to Mediterranean-type climates and irrigated viticulture) center on the management of grapevine water status and cold temperature injury. Many growers in eastern viticultural regions rely on frequent rainfall during the growing season and do not have the capacity to irrigate vines.

Rootstocks can improve the water status of their scions, a valuable characteristic during periodic low rainfall years. Rootstocks may improve vine water status even under normal rainfall conditions, enhancing the ability of the vine to compete with herbaceous ground covers in the row middle.[1]

Vineyard locations prone to wet soils present another challenge, including in the spring, when wet soils are slower to warm up than dry soils. K. Striegler et al. found vines grafted on Rupestris St. George to be more tolerant of waterlogging than own-rooted vines.[23]

R. Pouget and J. Delas demonstrated that some rootstocks were superior to others in adaptation to high water content of soils in the spring.[14] Present recommendations to install drainage in wet vineyards provide a durable management practice to address wet sites, although there is increasing grower interest in rootstocks for these locations.

Winter survival of grafted vines is a key consideration in rootstock use. In colder areas, protection of the graft union during the winter is recommended.

Where sufficient persistent snow cover is available, snow may provide adequate protection of graft unions. If snow cover is not consistent, soil is mounded over the graft union for the winter and is removed in the spring. This presents an additional cost for managing grafted vines and constitutes a renewing cost-disincentive for rootstocks.

There is enormous grower interest in the potential direct and practical impact of rootstock variety on scion response to cold weather. E. E. Hoover et al. evaluated the impact of rootstock variety on bud hardiness and vine survival in Minnesota.[11] The impact on bud hardiness in controlled freezing experiments was minor, but they reported substantial differences among rootstocks in vine survival over the course of the experiment.

Of particular interest is the potential for evaluating rootstocks to determine

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their impact on cold hardiness of scion buds during deacclimation. K. Striegler and G. S. Howell demonstrated that, during deacclimation, buds of Seyval grafted on Cynthiana were more cold-hardy than those of Seyval grafted on St. George.[22] Deacclimation bud hardiness enhancement could be very useful, especially in those regions prone to late frosts.

Acidic vineyard soils (pH 5.5 and below) are associated with poor vine performance in many locations across eastern North America.[3] Grapevines under stress from soil acidity can show reduced shoot and root growth, lower yield, and leaf spotting, necrosis, and other symptoms.

The severe condition of stunting and lesions even has its own name, "Sauerschaden" or acid-soil sickness. Aluminum toxicity most often is reported as the limiting factor, due to the increased bio-availability of aluminum ions as soils become increasingly acidic; copper, iron, and manganese toxicities also are implicated.[10] Deficiencies of calcium, phosphorus, magnesium, and boron are common in grapevines grown on acid soils.

In a recent survey of western New York vineyards, T. R. Bates found that the average soil pH had decreased substantially since a 1934 survey.[3] Liming is routinely used to reduce soil acidity, but on acidic soils, liming may be necessary annually and at high volumes merely to maintain pH slightly above the native pH, and the effects of liming may be limited to the upper portions of the soil.[20]

Repeated use of nitrogen fertilizers, common in viticulture, contributes to increased soil acidity.[9] Acid soils, already challenging for grape growers, are becoming more acidic, and even the acidity of more neutral soils is increasing following generations of nitrogen fertilizer application.

Rootstocks have been evaluated for their ability to enhance vine growth and performance on acid soils in vineyards. T. Bates and H. Walter-Peterson [preliminary data, personal communication] evaluated the value of Gravesac, a rootstock reported to be tolerant to acid soils,[6,15] for four scion varieties grown on acid soils in Fredonia (Lake Erie viticultural region of western New York). Gravesac improved vine size and yield compared to own-rooted vines; however, even vines grafted on Gravesac responded to lime applications.

Gravesac has not been evaluated extensively in the U.S, but the promising results of Bates and Walter-Peterson point to its potential usefulness on acid soils, especially in combination with liming.

Rootstock varieties and sources

Reliable statistics for rootstock variety utilization across eastern North America are not available at this time. Many sources of grafted plant material

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are used and trade in plant material among states influences rootstock utilization and evaluation.

California's large grapevine nursery industry supplies many vines to the eastern U.S., both through direct sales of rootstock and scion budwood or cuttings and contracted grafting for nurseries based in eastern states. This means that California's rootstock demands shape availability for eastern growers.

Some growers graft their own vines or produce small lots for sale. Interstate movement of plant material, including grafted vines, rootstock cuttings, and scion budwood, is common and serves to complicate the collection of information on rootstock varieties in vineyards now and what growers are planning for new vineyards.

Most of the rootstocks commonly planted in the region are typical varieties employed internationally for phylloxera protection. Overall, a longer history of *V. vinifera* cultivation in a particular area and a greater extent of *V. vinifera* cultivation tends to relate to greater diversity of rootstock varieties used.

3309C is in widespread use and might fairly be considered the "standard" rootstock for eastern North America, where it is considered a moderately vigorous rootstock that provides some relief from periodic drought.

Use of 101-14 Mgt appears to be increasing and some vineyards on 3306C are in place. Riparia Gloire and, to a limited extent, 1616C are employed where small vine size is important. In the *V. berlandieri* x *V. riparia* group, Kober 5BB and SO4 are popular, with Teleki 5C and 420A also planted. More popular *V. berlandieri* x *V. rupestris* rootstocks are 1103P and 110R.

Regionally, a few rootstocks that are currently of limited importance in western North America are used. Some such rootstocks may be remaining plantings from larger evaluation trials, while others are still propagated, but on a smaller scale. 1613C, once important in the San Joaquin Valley, but now mostly supplanted by Freedom and Harmony, is in limited plantings, valued for small vine size in its scions.

Millardet 143A, a *V. vinifera* x *V. riparia* hybrid, remains in a few areas. Slate Quarry 1 (synonym SQR1), a *V. riparia* rootstock selected from nature in Pennsylvania, is suggested as a low vigor rootstock, although its presence in cultivation is minor.

In the mid-1980s in the Finger Lakes, there was a move to top-work/convert Concord or low-value hybrid-direct producers to *V. vinifera* or other higher value varieties. A few Chardonnay and Cayuga White blocks on Concord or Baco noir rootstock are still producing.

Future of rootstock use and evaluation in eastern North America — Rootstocks will continue to be used primarily to provide protection against

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pests and diseases. Trends in variety utilization and the science of viticulture will drive rootstock variety choices.

Additional rootstock varieties evaluated, introduced, and utilized in California, Europe, and elsewhere will be planted and evaluated in eastern North America. Gravesac will lead the pack, and there is interest in evaluating newly released rootstocks bred by Andrew Walker (UC Davis) and by Mike McKenry (UC Riverside).

Continuing evaluation of rootstocks and their interaction with scion varieties will provide recommendations for growers concerning the choice of rootstocks for particular soil-borne pest and disease challenges.

Additional applied research is needed to determine the value of particular rootstock varieties in managing nematode-transmitted viruses, crown gall, and grape root borer. In each case, rootstocks already show promise in providing useful pest or disease management.

The value of resistance to *X. americanum* and other virus-vectoring nematodes is not well understood in eastern North America, and the interactions of nematode, virus isolate, rootstock, and scion need more characterization. Particularly in the Midwest, growers report unusual virus disease-like symptoms from some varieties (such as Norton and Chardonel); yet in some cases, virus testing has not been informative as to what might be inciting these symptoms.

Are different tomato ringspot virus and PRMV isolates causing disease preferentially in some varieties? Do particular nematode populations preferentially transmit particular virus isolates?

The relationship between virus isolate and host plant response forms the well-documented and utilized basis for woody plant indexing for grapevine virus testing — could we see a comparable diversity in host-plant response to virus infection among rootstocks and scion varieties used in eastern North America? If so, we may expect to see an increasingly complex picture of rootstock/scion/virus interactions as new rootstocks and scion varieties of diverse genetic background are introduced into cultivation.

New varieties from breeding programs in eastern North America are trending toward more and more *V. vinifera* parentage and characteristics, with an emphasis on improved fruit and wine composition in addition to better cold hardiness and resistance to powdery mildew and downy mildew. Some will be *V. vinifera* varieties, and others interspecific hybrids (in some cases combining germplasm from hybrid-direct producers and American hybrids).

The introduction of plant material from Europe, including interspecific hybrids and *V. vinifera* varieties, contributes to this trend toward scion varieties that are more susceptible to dam-

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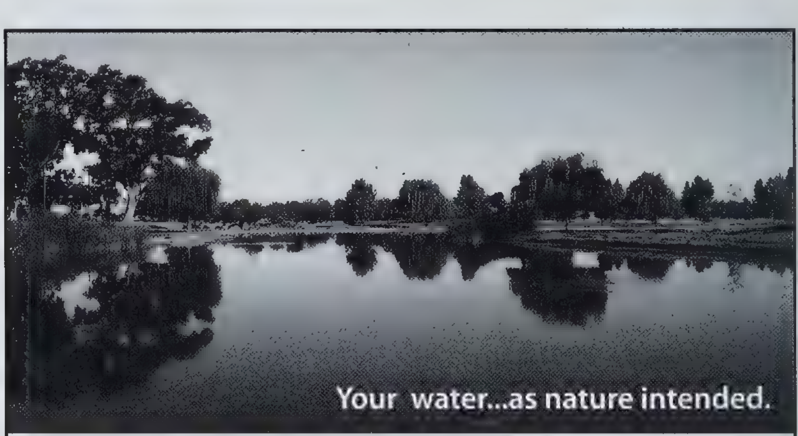

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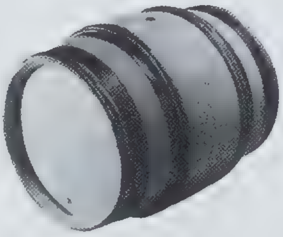

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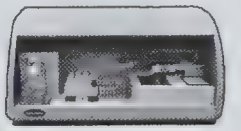

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age from phylloxera (compared to many hybrid-direct producers and American hybrids, traditionally and frequently grown own-rooted).

In some areas, sites presently planted to hybrid-direct producers or American hybrids will be converted to *V. vinifera* plantings (this transition is also happening in Canada). The consequence of more *V. vinifera* and more *V. vinifera*-like scion varieties will be more utilization of rootstocks for phylloxera protection.

For example, grafting on phylloxera-protective rootstocks is recommended for Valvin Muscat, a high-quality interspecific hybrid white wine grape bred at Cornell University,[18] as grafting substantially increases vine size and yield.

However, some very vigorous interspecific hybrids, such as Noiret, are suggested as candidates for low vigor rootstocks for improving canopy management, fruit and wine composition, and vine longevity due to phylloxera protection.

Summary

More vineyards of more fruiting varieties will be grown on more varieties of rootstocks in eastern North America in the future. The enormous diversity of fruiting varieties, vineyard sites, climates, and pests and diseases presents a substantial hurdle to comprehensive evaluation of rootstocks in the region as a whole, but meaningful progress has been made in determining the specific regional value of grapevine rootstocks and prospects are encouraging for continuing positive impacts of applied research. ■

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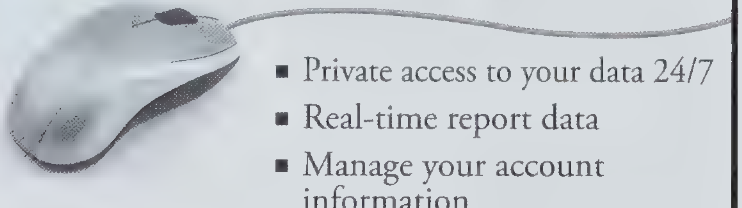

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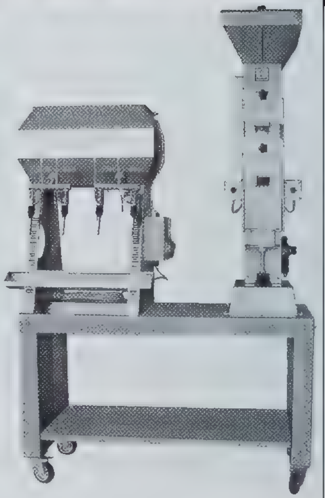

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ENERGY EFFICIENCY SERIES

Jordan Winery UPGRADES reduce ENERGY use

BY Tina Vierra

Jordan Winery (Healdsburg, CA) embarked on several projects to improve the efficiency of their production facility, beginning in 2007. Tim Spence (Jordan's director of facility operations) has replaced an inefficient refrigeration system, installed lighting retrofits, a new piping system, and new roll-up doors.

Resource Solutions Group (RSG, Half Moon Bay, CA) advises wineries in identifying energy efficiency improvements to existing equipment that help meet operational and sustainability goals, and to secure rebates offered by Pacific Gas & Electric Company (PG&E, San Francisco, CA).

The RSG Wine Industry Efficiency Solutions (WIES) program was established in 2006 as a third-party program in PG&E's energy efficiency portfolio, to offer no-cost services for PG&E customers including: energy audits, project analysis, implementation support, and financial incentives to help achieve cost-effective energy-efficiency measures, with quick turnaround on project completion.

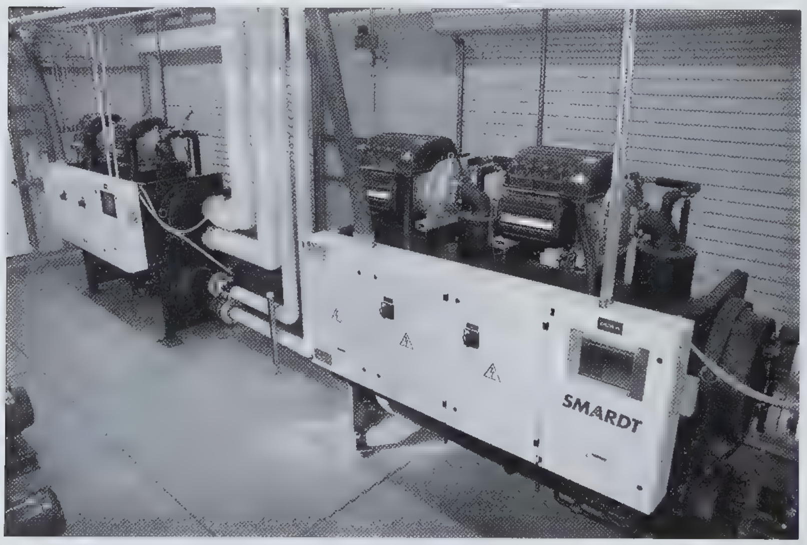
Chris Pilek (WIES Program Manager of RSG) began advising Spence and his team on continuing retrofits at the winery in January 2008. The WIES program conducted a comprehensive energy audit of the Jordan facility, analyzing baseline equipment conditions, making recommendations for upgrades, and identifying opportunities to reduce energy consumption.

Efficiency projects at Jordan Winery

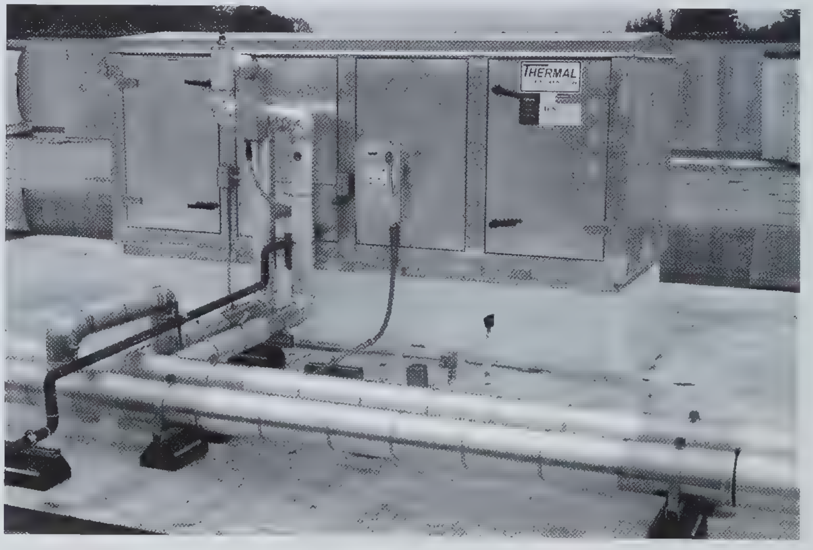
Re-roofing of the Jordan barrel room began in October 2007 and was finished in early 2008. Crews removed two layers of roofing — the original roof and an 18-year-old roof addition, replacing them with four inches of ridged insulation topped with a "cool roof." The white vinyl cool roof is heat-reflective to reduce heat gain.

28, 400-watt metal halide light fixtures in the case goods warehouse and 25 outdoor fixtures were replaced with more efficient T8 fluorescent fixtures in 2008. Lighting retrofits continued in 2009 with 11 new fluorescent fixtures in the fermentation room and 12 in the barrel room. All new lighting was placed on motion sensors so that the lights will turn off if no one is working in a room.

T-8 fluorescent lighting in fermentor rooms, casegoods warehouse, and barrel room reduces energy use by 58,215 kWh per year.



The Smardt chillers are water-cooled and have magnetic bearings, reducing friction, energy use, and maintenance costs.



Six air-handlers atop the barrel room and five atop the casegoods warehouse, are key components of the energy-efficient new system.

Pilek projected the annual reduction in energy use with new lighting at 1,200 kWh per fixture. Through the WIES program at RSG, Jordan has earned $7,380 in lighting incentives, and reduced consumption by 58,215 kWh per year.

The winery is reclaiming process water for use on its landscaping. Spence's goal for 2010 is to reclaim 2,000,000 gallons.

Four steel roll-up doors were replaced — two on the warehouse loading dock in 2008 and two in the barrel room in 2009. The original steel doors, all on south-facing walls, absorbed significant heat gain from sun exposure. The new Thermocore-981, 12x12-foot roll-up doors have a foam insulation core and aluminum skin, reducing the heat load on the cool rooms. The WIES program obtained rebates for Jordan Winery on the two doors replaced in 2009 of $2,117, and the estimated reduction in energy consumption by the winery is 15,330 kWh per year.

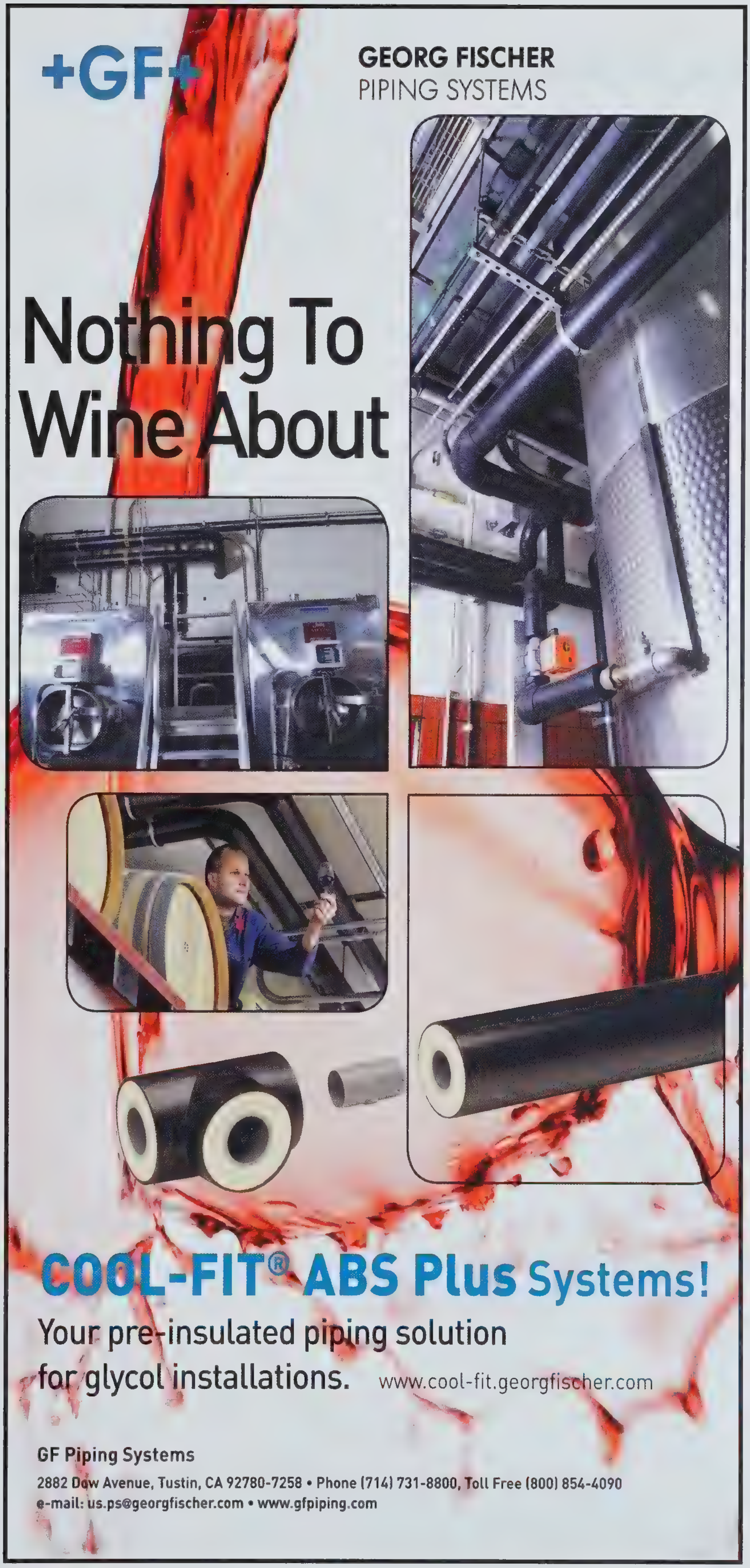
Spence and his team also made small efficiency upgrades, such as LED lighting in offices and a new energy-efficient refrigerator in the winery's kitchen. Restrooms were retrofit with more efficient fluorescent lighting and motion-sensor faucets in 2009.

Utility rebates for refrigeration systems

Jim Chaaban, senior account manager for wineries with the PG&E Service and Sales Division, has credited the winery with incentives on new, more energy-efficient equipment installations. Since 2007, PG&E reports Jordan Winery's participation in incentive programs has earned $46,485 in rebates, saved 340,988 kWh, and reduced energy demand by 31 KW annually.

Pilek explains that retrofit rebates fall into two categories, **prescriptive rebates** and **customized incentives**. "Rebates are simple — where enough field data has been collected over time for a certain type of energy efficiency project, a generic energy savings can be assigned and a standard cash amount is provided," he says. "A catalog listing the rebates available is on the PG&E website and includes many types of projects.

"**Customized incentives** are more complex, as each winery's potential energy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reduction varies based on its equipment and operating conditions. Where catalog rebates are too narrowly defined or do not address the winery or vineyard's specific energy savings opportunities, a **customized incentive** can be calculated based on the specific equipment in use, hours of operation, and other factors. Most wineries are not aware of this path, and assume if it is not in the catalog, no rebate is available."

The **customized incentive** option involves pre-project discussions with PG&E or PG&E partners on the energy-saving options available, documenting before and after conditions, development and review of energy savings calculations, and in many cases, field measurements. With careful management, **customized incentives** give wineries access to a broader variety of energy efficiency projects that are eligible for rebates.

Typically a winery would need to hire an engineering firm to help develop the appropriate energy savings calculations and represent them to PG&E's technical reviewers in order to take advantage of this type of energy efficiency incentive. Wineries can start the **customized incentive** process at no-cost by consulting with their PG&E field representative, who will explain the resource options available for improving energy efficiency, or by calling the PG&E Agricultural Customer Service Center at 1-877-311-FARM (1-877-311-3276).

PG&E customers and WIES program participants can take advantage of **prescriptive rebates** from the Ag/Food Processing Rebate Catalog including:

- Wine tank insulation (rebates increased in October 2009 to $2.25/square foot for indoor tanks, $3/square foot for outdoor tanks-Coastal, and $3.75/square foot for outdoor tanks-Central Valley);
- Strip curtains for walk-in boxes ($3/square foot);
- Pipe insulation for boiler systems (up to $4/linear foot);
- Replacement of HID or incandescent fixtures with fluorescent fixtures (up to $125/fixture);
- Replace T12 fixtures with T5 or T8 (up to $7.50/lamp);
- Occupancy sensors (up to $44/sensor);
- Efficient evaporator fan motor ($20/motor);
- Evaporator fan controller for walk-in coolers ($75/controller);
- Steam or water process boiler ($2/MBtuh);
- Insulation for bare suction lines ($1/linear foot).

Retrofit projects that qualify for PG&E **customized incentives** include:

- Replacing old chillers with energy efficient models that include motor controls to automatically ramp up and down based on refrigeration need;
- Installing variable frequency drives on glycol pumps and condenser fans;
- Installing controls to cycle evaporator fans;
- Installing controls for floating head pressure and suction pressure;
- Installing energy-efficient motors;
- Replacing air cooled condensers with evaporatively cooled condensers;
- Efficient aerators for wastewater ponds;
- Dissolved oxygen sensors for wastewater ponds;
- Air compressor upgrades and replacements;
- Glycol pipe and tank insulation;
- Refrigerant heat recovery devices;
- Barrel washing heat recovery.

As of January 2009, the PG&E ACR (air conditioning and refrigeration) rebate is $0.15/kWh saved, the ACRII rebate is $0.09/kWh saved, and $100 is credited for the reduction of each kW.

On September 24, 2009, the California Public Utilities Commission (CPUC) authorized the largest three-year state energy efficiency program (2010-2012) in the U.S. to the tune of $3.1 billion. New

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PG&E energy efficiency rebates and incentives are being finalized. Applications received for products purchased and installed on or after January 1, 2010, are eligible for the new rebates.

Wineries should check their utility's website for the most current rebates and incentives available that are subject to change.

Jordan Winery's refrigeration system

Jordan Winery achieved its biggest reduction in energy use by replacing its refrigeration system.

"The Jordan facility requires refrigeration to chill jacketed wine tanks during harvest," Chaaban explains, "and to maintain cold storage for barrels and case goods year-round. The Jordan project qualified for PG&E's **customized incentive** program, and provided the winery with an annual savings of 261,001 kWh, reduction of 14 KW of demand, and a PG&E incentive of $36,540."

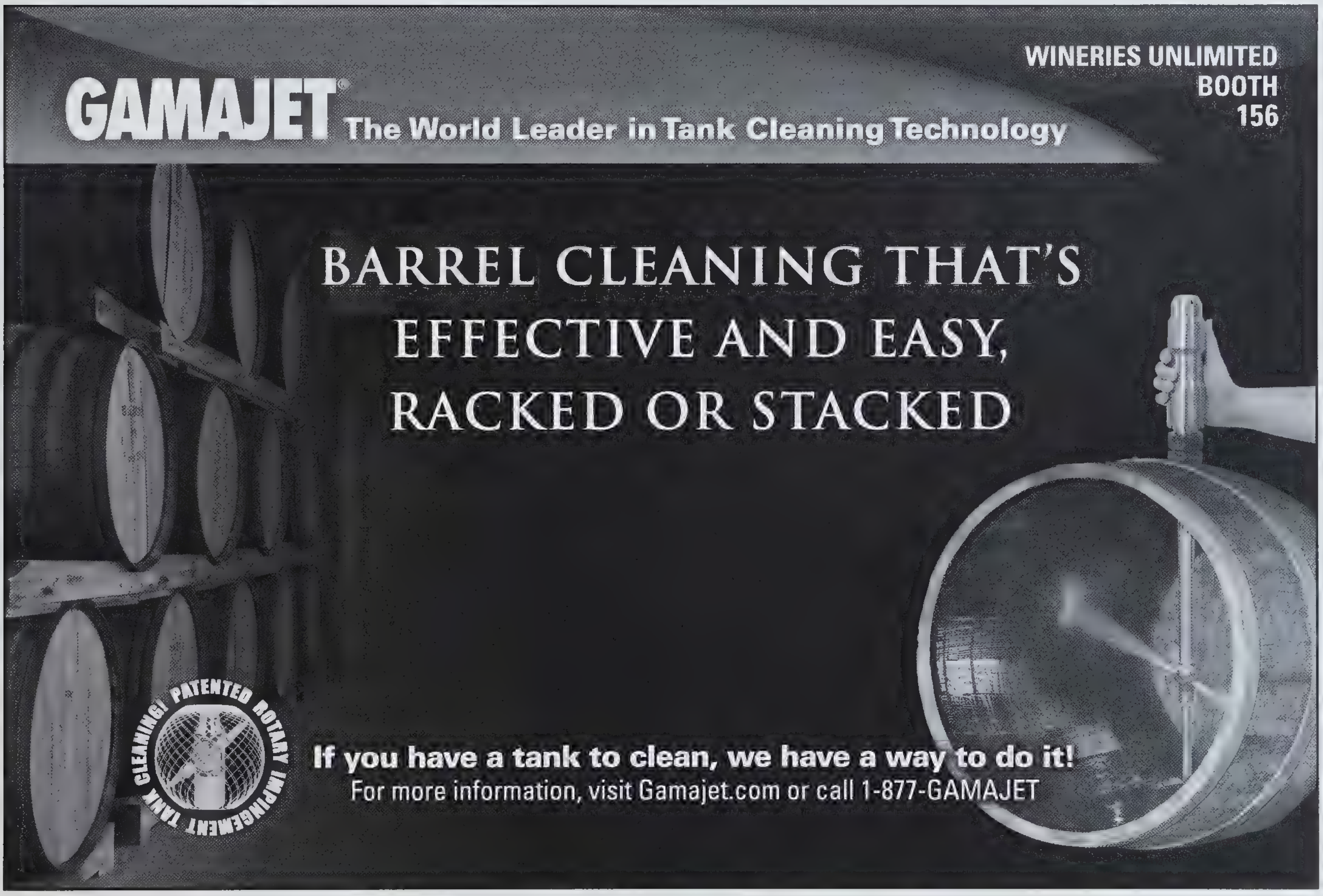
Spence chose his existing maintenance contractor, Indoor Environmental Services (IES, Santa Rosa and Sacramento, CA), to install the new refrigeration system.

"The winery's existing mechanical system contained a wide variety of equipment that was added on and changed over many years," says Ken Petro, CEO of IES. "Service repair costs and the age of some equipment were concerns that led the winery to choose to upgrade. We designed an energy-efficient mechanical system retrofit, replacing existing chillers, air handlers, and the control system."

Three key energy-saving features of the new systems at Jordan Winery are:
1) Two Smardt chillers with Turbocor compressors: Replacing conventional reciprocating compressors with Turbocors resulted in a drop from 1.3 kW/ton to 0.7 kW/ton;
2) Two Evapco cooling towers: Changing from air-cooled to water-cooled compressors further dropped the energy usage from 0.7 kW/ton to 0.5 kW/ton;
3) Six air handlers and two circulation pumps, and changing direct-expansion controls to a Honeywell/Tridium control system.

The Turbocor compressors with the water-cooled Smardt chillers are the latest in modern compressor technology, with magnetic instead of traditional bearings, eliminating both mechanical wear due to friction, and the use of oil. The variable-speed compressors can be adjusted up or down depending on winery demand. PowerPax electronic expansion valves, and the optional use of load-balancing valves at very low loads are included.

"Field reliability has been outstanding — not surprising when you consider that 80% of all chiller problems in the field are due to failures in compressor oil return, and the Smardt chillers use no oil," explains Joe Cortese, PE, IES project engineer in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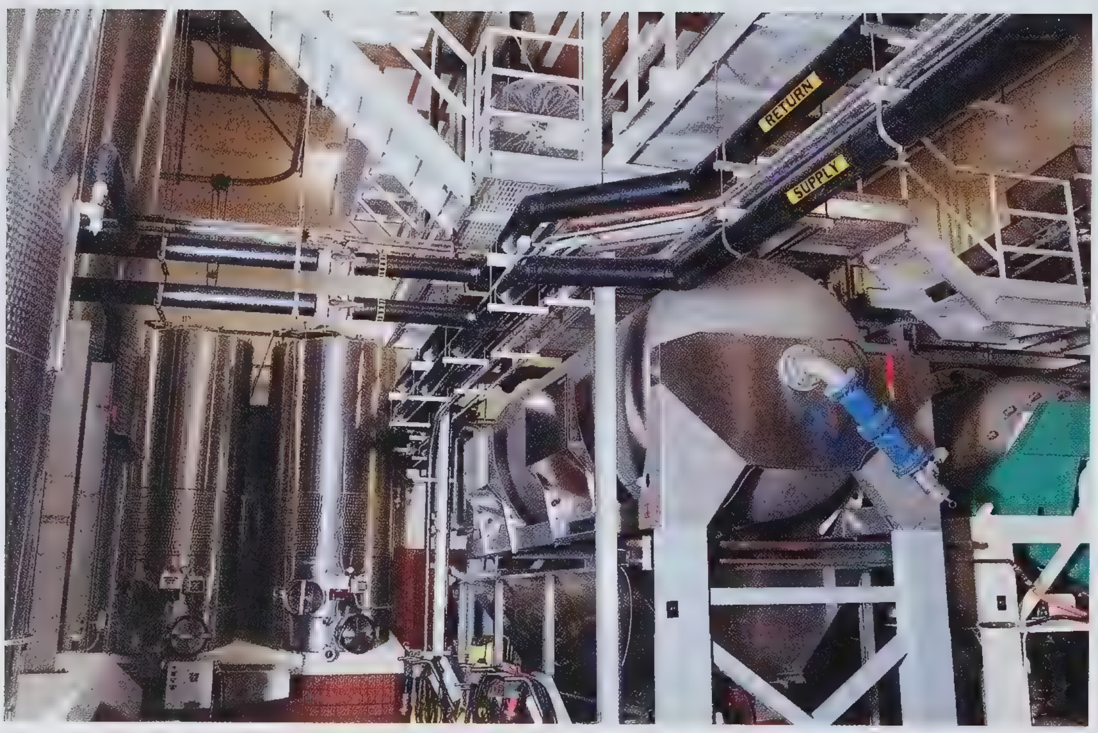

COOL-FIT ABS Plus piping supplies and returns chilled water to fermentation tanks. [Left center, above tanks] Manual COOL-FIT ABS 546 ball valves can isolate supply and return to individual tank aisles.

charge of the Jordan installation. "Turbocor-trained engineers and technicians have found that total maintenance costs for oil-free chillers are well under half the cost of traditional, lubricated chillers.

"The elimination of oil usage for lubrication ensures that the efficiency of the Turbocor compressors remains constant over the years. In older technology, oil usage would lead to a gradual degradation of the heat transfer of the chillers."

The Honeywell/Tridium controls regulate all aspects of the mechanical system, from the start/stop of chillers, to humidity and CO_2 levels, temperature, and operating pressure of each compressor. The controls monitor, mark trends, and archive data for future reference. The Web-based system allows winery personnel remote access to 125 set-points. The combined technologies of the chillers, compressors, and controls deliver energy-use reduction along with very quiet operation.

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Jordan Winery reduced energy use by 108,600 kWh in its first year with the new equipment. System demand on the utility's grid was reduced by 14kW in 2008. PG&E credited the winery $36,540, based on an estimated energy-use reduction of 261,000 kWh per year with the new system.

Testing with Elite Pro meters shows that the actual performance of the new chillers is far better than originally calculated. Engineers believe the industry-standard SPC Estimation Software and engineering calculations used to give wineries the catalog rebate amounts are too low for the high-performing Turbocors.

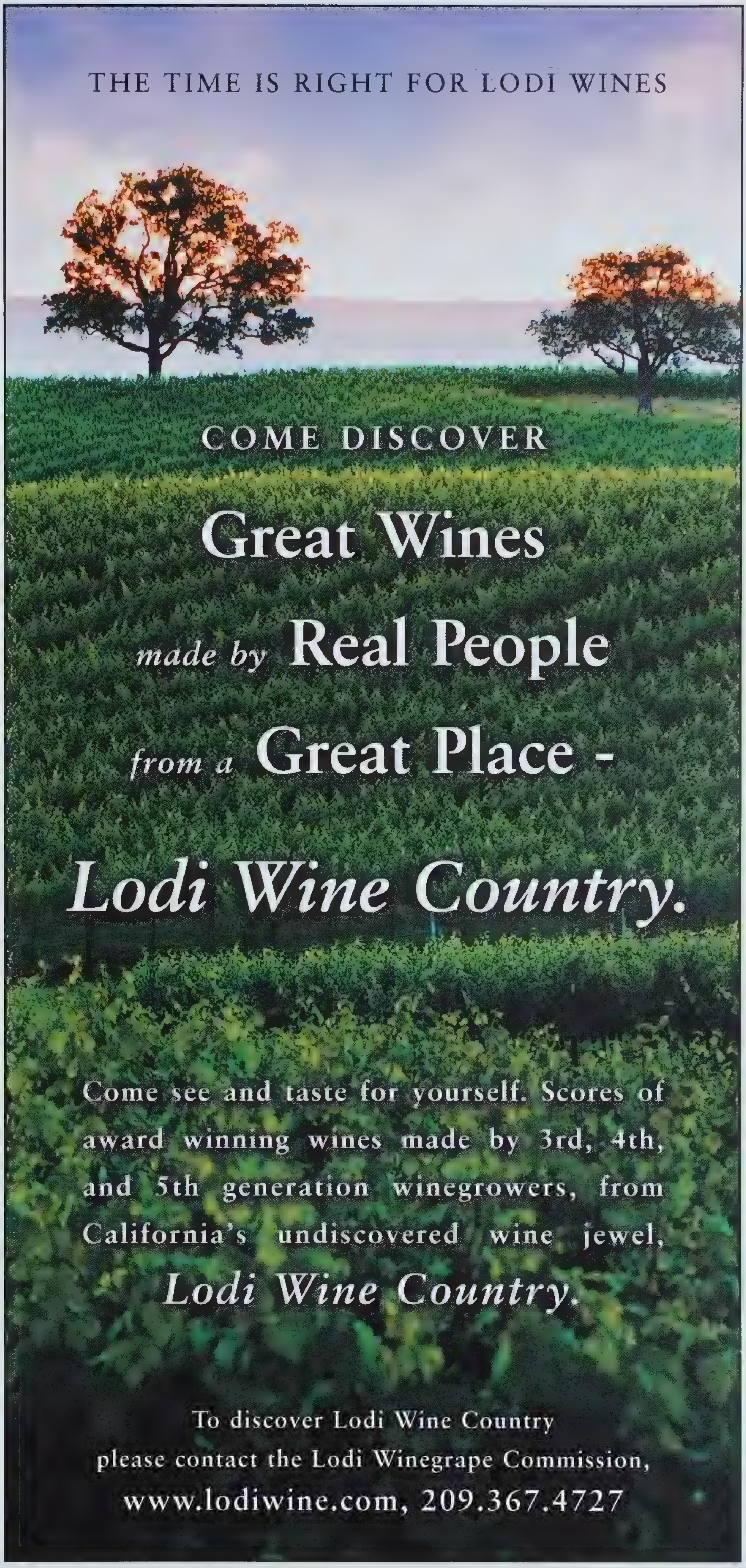
Jordan Winery's condenser system loop is completed with two Evapco fluid coolers receiving water from two condenser pumps, while two system pumps circulate chilled water to air handlers throughout the facility. The fan motors in the cooling towers have variable-frequency drives, minimizing the energy required to operate the fans while achieving required heat rejection.

In March 2009, Spence's team upgraded the case goods warehouse with five more air handlers, and put two outside tanks onto the new cooling system.

More than 1,200 feet of old piping throughout the fermentation cellar was replaced by a new COOL-FIT™ ABS Plus pre-insulated piping system (175 feet of 4-inch diameter "main" lines, 400 feet of 3-inch diameter piping in tank aisles, and 650 feet of 1½-inch diameter connections to tanks). The system includes pipes, fittings, manual and actuated valves, and measurement and control devices. The pipe is black, UV-resistant insulated plastic, suitable for outdoor or indoor mounting. Spence reports that the system delivers chilled (as low as 32°F) water to fermentation tank jackets.

The unusual pipe joints fit together internally and are sealed with a solvent, so the insulation is not removed to perform joints, and seals are water- and vapor-tight. The smoothness of the plastic interior of the pipes inhibits deposit buildup and flow reduction, so the pipes experience less pressure loss and contribute to greater system efficiency.

With the further system upgrades and refinements to the new equipment to improve its performance in 2009, in early December, Spence measured Jordan's reduction at 221,407 kWh for 2009.



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Future efficiency improvements at Jordan Winery

Pilek reports that recommendations for further lighting retrofits and a wastewater pond aerator upgrade are among the next group of projects from the WIES Program at Jordan Winery in early 2010. The energy reduction, if implemented, is estimated at 75,000 kWh per year, about $11,250 in annual cost savings.

Spence and Chaaban reviewed the winery's utility rate structure in January 2010 to explore switching some of the winery's agricultural accounts to more suitable rate schedules. The idea came from Chaaban, who believes that if the winery qualifies for a better rate schedule, Jordan Winery may save up to $5,000 per year.

In January, Jordan Winery implemented a new "Power Shaver" program recommended by IES. Cortese and Nicholas Moen of IES installed five "power factor correction" devices on large equipment motors at the Jordan facility. Field-tested at the winery in summer 2009, the devices are expected to improve the power factor of the energy pulled from the utility grid from 85% to 95%.

Moen explains that the devices are designed to flatline energy spikes in motors operating at 7 hp or above on startup (acting as voltage regulators), and to increase the motors' ability to maximize the use of power as it comes in from the utility grid (converting wasted magnetic energy to useful energy). Acting as capacitors reducing wasted current, the devices should allow the motors to get more use out of the energy they pull from the utility grid, thus reducing the amount of energy needed to run them.

Spence believes Jordan Winery will be one of the first wineries to use the Power Shaver devices, and thinks the experimental program (not eligible for utility rebates) will pay for itself in energy-cost savings. IES estimates the payback period of the installation at 2.46 years, and that the winery can save $14,866 per year on energy bills.

PG&E does not recommend using power factor correction equipment to save energy, nor are any PG&E incentives available for power factor devices.

Spence and his team continue to monitor the winery's energy use, vineyard and winery operations and practices, and overall carbon footprint. His eventual goal? "With facility improvements and future projects, we hope to become carbon neutral," replies Spence. ■

Resources

The website for wineries and vineyards interested in utility rebate programs in California is www.pge.com/wineries/.

IES (Indoor Environmental Services) can be found at www.ies-hvac.com/.

Information about the Wine Industry Efficiency Solutions program (WIES) offered by Resource Solutions Group can be found at www.rsgrp.com/wine.php.

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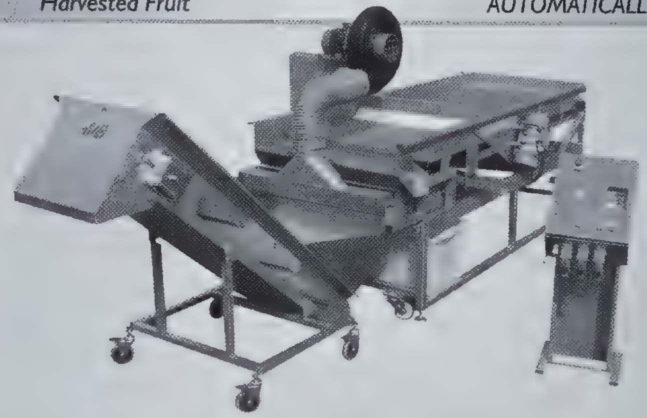

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Post-bottling management

Continued from page 21

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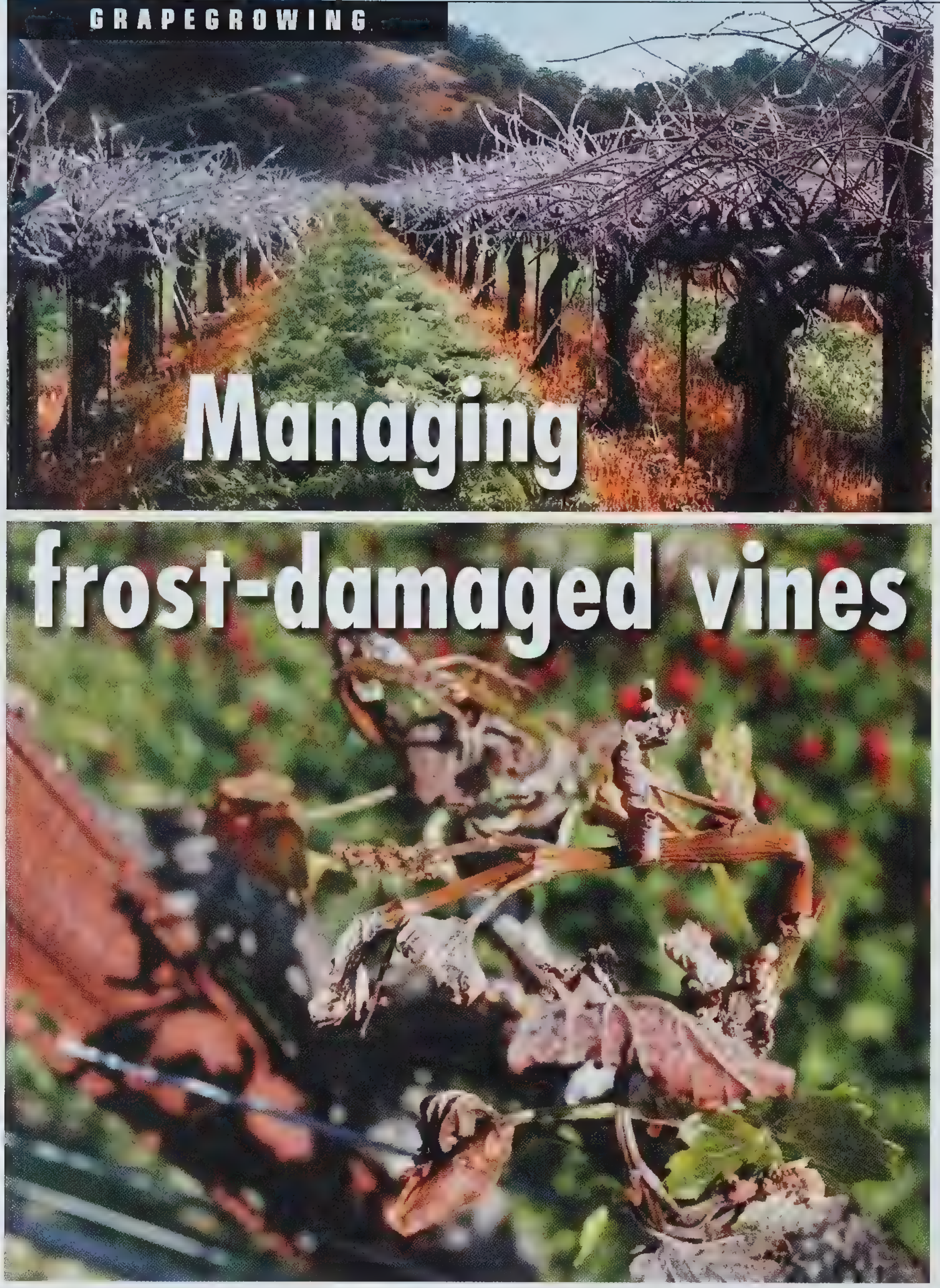

[Top] Frost protection, spring 2008. Photo by Steve Sterling of Esterlina Vineyards. [Bottom] Shoots damaged by frost, spring 2008.

BY Glenn McGourty, Farm Advisor,
Jim Nosera, Agricultural Technologist,
Prahlada Papper, post-graduate researcher,
UC Cooperative Extension,
Mendocino County, CA,
David Koball, Director of Vineyards for
Fetzer & Bonterra Vineyards,
Chad Bordman,
Bonterra Vineyards Manager,
Hopland, CA

There is nothing sadder to most growers than looking at their vineyard following a damaging frost in the spring, unless it is a frosted vineyard in the fall before they pick the ripening fruit.

Green grapevine tissue is damaged whenever temperatures fall below 32°F for longer than 20 minutes. In spring, emerging shoots contain developing flowers that are very prone to freezing damage.

The spring of 2008 was one of the most difficult frost seasons in many years for growers on the North Coast of California, with numerous nights of low temperatures and low dew points. Normally, **radiant freezes**, in which the air is stratified and only vineyards planted on the lowest areas of the landscape experience freezing, are common.

On the evening of April 20, a large cold air mass created **advective freezing** conditions, and many vineyards were damaged; since there was no temperature stratification, no matter where a vineyard was on the landscape, it was exposed to freezing temperatures. In this frost event, upland vineyards that normally are above cold stratified air were damaged.

Because of the low dew points, temperatures dropped rapidly, and even some vineyards that were frost-protected with sprinklers incurred injury because the systems were turned on at too low a temperature considering the low dew points. In these low-humidity conditions, evaporative cooling of the water that was applied actually cooled the vineyards to below freezing temperatures instead of protecting them.

Growers often wonder if there is an advantage to immediately pruning damaged shoots to stimulate secondary buds that might flower and set a smaller crop. Some varieties tend to do this on their own, such as Pinot Noir, Arneis, and Zinfandel. Since the potential for harvest-income is limited following a severe frost, some growers do minimal maintenance in the vineyard, primarily suckering the trunks and controlling powdery mildew. In this study, we looked at different ways of treating damaged vines to stimulate new shoot development.

Materials and Methods

Two sites were chosen: a Chardonnay vineyard (CTPS #96 on 101-14 rootstock) planted on a 7 foot x 8 foot spacing (778 vines per acre) along the Russian River in deep soil (Russian River loam) in Hopland, and a Cabernet Sauvignon (CTPS Clone 337 on 1103P rootstock) vineyard on an upland site above the Ukiah Valley planted on a 5 foot x 8 foot spacing (1,089 vines per acre) in shallow soil (Redvine clay loam).

On the night of the April 20, 2008 freeze, damaged shoots in the Chardonnay vineyard had emerged about four inches in length, and shoots in the Cabernet Sauvignon vineyard had emerged about two inches in length.

Treatments were as follows:

- Control, in which the vines were left alone for dormant buds to emerge;
- Damaged shoots were removed by hand by breaking them from the spurs;*
- Damaged shoots were removed by cutting back to the base where current season tissue is connected to the previous season's woody tissue; and
- Whole spurs* were removed along with the damaged shoots to encourage basal buds to sprout in the spur position.

*NOTE: A "spur" is the basal node of the previous year's woody growth containing two buds.

A randomized complete block experimental design consisted of the four treatments replicated four times. In the Chardonnay trial, each replication consisted of 10 vines (40 vines per treatment), with a total of 160 vines in the trial. In the Cabernet Sauvignon trial, each replication consisted of 6 vines (24 vines per treatment), with a total of 96 vines in each experiment.

Treatments were applied to the Chardonnay vines on May 2, 2008. Treatments were applied to the Cabernet Sauvignon vineyard on May 13, 2008.

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Table I. Chardonnay: HARVEST STATISTICS

Treatment	Avg. Cluster Weight (g)	HG*	Avg. Cluster Count	HG*	Avg. Yield/Vine (Kg)	HG*	Avg. Yield/Acre (tons)	HG*	% Change from Control
Control	42.34	a	162.00	a	0.65	a	0.56	a	—
Break Damaged Shoots	47.52	a	218.75	ab	1.04	b	0.90	b	**60%**
Cut Spurs	47.44	a	241.00	bc	1.14	bc	0.97	bc	**74%**
Cut Damaged Shoots	45.12	a	307.25	c	1.39	c	1.19	c	**112%**

Table II. Chardonnay: CHEMISTRY

Treatment	Berry Weight (g)	HG*	Brix	HG*	pH	HG*	Titratable Acidity (grams/100cc)	HG*
Control	0.98	a	20.7	a	3.6	a	0.91	a
Break Damaged Shoots	1.03	a	21.1	a	3.6	a	0.91	a
Cut Spurs	0.98	a	20.7	a	3.6	a	0.91	a
Cut Damaged Shoots	1.06	a	21.2	a	3.6	a	0.88	A

Table III. Chardonnay: SHOOT EMERGENCE AND REGROWTH

Treatment	# of Spur Positions Per Vine	HG*	# of New Shoots on Spurs	HG*	New Shoots on Cordons	HG*
Control	13	a	5.60	a	22	a
Break Damaged Shoots	13	a	3.15	b	35	c
Cut Spurs	12	a	8.70	c	30	b
Cut Damaged Shoots	13	a	8.70	c	36	C

***Values followed by the same letters are in homogeneous groups**

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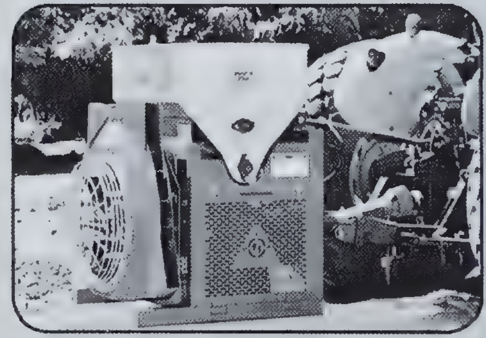
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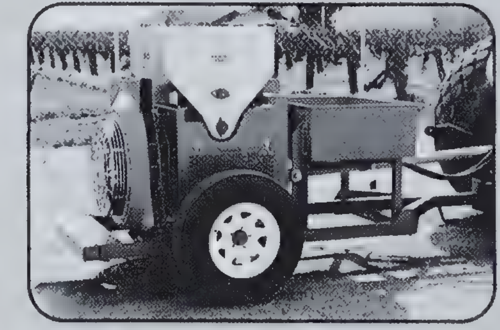
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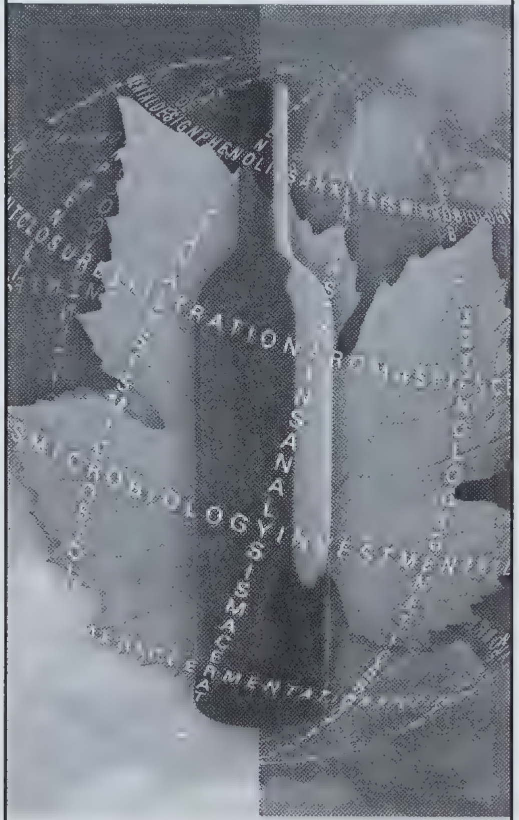

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The case for double-pruning

BY Glenn McGourty, Farm Advisor, UC Cooperative Extension Mendocino County, CA

Before the days of modern frost protection, the primary techniques to keep vineyards from freezing involved site selection (upslope, since cold air drains downward like water); clean tillage (compacted, tilled soil retains heat, and weeds can be a source of ice-nucleating bacteria, increasing frost risk); planting varieties that bud out late; and double-pruning. The four techniques were widely used in the cooler parts of the North Coast of California on old, head-pruned vines such as Zinfandel, Carignane, and Petite Sirah.

When the vines are double-pruned, the canes that are selected to be cut back to spurs are left long, and then pruned after the buds begin to open in the spring. Since the terminal buds on the tip of the shoot produce auxin (indole acetic acid), there is a sequence of bud opening from shoot-tip to the base. The basal buds are inhibited from pushing open.

Seven to ten days may pass between the opening of the terminal buds and the basal buds. Sometimes the effect continues even after the terminal bud has been removed (especially in cool weather), since auxin is systemic. What growers do is wait for bud break on the tip of the shoots, and then cut above the two buds they want to keep.

Since frost events usually happen early in the season, this may keep those two basal buds in dormancy an extra week, which can be significantly helpful in protecting the crop. On the other hand, if you are in a location that is not likely to freeze in the spring, but the season is short due to low temperatures, you could lose one week of ripening weather during the growing season, which can affect quality at harvest if rains are a potential problem.

Another possible problem is that some varieties may become so inhibited by the auxin that they go into complete dormancy, and do not push a shoot following the second cut. You then end up with single canes on the spurs, and a reduced crop.

Dave Koball and Chad Bordman of Fetzer/Bonterra Vineyards experimented with this technique during the 2009 growing season. They long-cane-pruned one block of Cabernet Sauvignon and then sequentially cut back the canes to see what kind of effect it would have to delay bud break. They found the technique effective, but the vines that were pruned the latest definitely showed a yield reduction. "There were fewer shoots and less fruit; we saw a significant yield reduction," reports Koball. Since it was an observational trial, no data were taken.

At Steele Winery (Kelseyville, CA), General Manager Steve Tylicki directs vineyard operations, including two heritage Zinfandel vineyards: the Pacini Vineyard on the Talmage Bench near Ukiah in Mendocino County, and the Catfish Vineyard on the Kelseyville Bench in Lake County.

Both vineyards produce small crops of intensely flavored fruit. Neither has a frost protection system. Tylicki uses two different approaches in pruning to address this. "Since Pacini is in an upland position, it rarely frosts there. That is one of the reasons that the vineyard was planted in 1943 by Italian immigrants. We think it is ideal when we have 'pussy willow' looking buds pushing at the tips of the canes, to finish the pruning at Catfish Vineyard.

"At Catfish, we long-prune. The difficult part is timing to get everything right. You need to keep an eye on things, which can be a challenge for me, since mostly I am at the winery, and the vineyard is two miles away. We prune off everything except the canes that we want to keep for current-year spurs.

"It is important to select a fairly vigorous shoot, and then cut the end-tip off just as it is starting to swell. If the shoot is too short, you do not have as good a delayed push of the basal buds. We find that if you have sap bleeding from the tip, you get more delay. If we leave a long shoot and remove the last couple of apical nodes, we obtain up to 10 days delay and frost protection.

"Finally, we wait for the pussy willow stage to do the final work and make a second cut when we think that freezing weather is over, removing the cane and retaining the two basal buds. This approach works well for that location."

Double-pruning has another benefit. UC Extension Plant Pathologist Doug Gubler and his team of researchers have been working on wood-rotting fungal disease, which causes various cankers, including *Eutypa* and *Botryosphaera*. "There is no question that late pruning is a good way to help manage the disease," explains Gubler, "especially with susceptible varieties like Cabernet Sauvignon and Sauvignon Blanc.

"Spore release from the fruiting bodies of these diseases is timed with rainfall, so the drier it is when you prune, the less likely that spores will be released to cause significant infection. We are also working on evaluating treatments to stop the fungus from infecting pruning wounds." ■

Since there was so little fruit in both vineyards, minimal cultural practices were performed, mostly consisting of sulfur dusting to prevent powdery mildew. No canopy management practices were applied.

In the Cabernet Sauvignon trial, emerging buds were removed between the spurs on the cordons of vines receiving treatments in a time-motion study. The workers were monitored as they applied the treatments to determine how much time each treatment would take on a per-vine basis. An average time needed to apply the treatment to one vine was then multiplied by the number of vines per acre, to arrive at a per-acre time for each treatment.

At harvest, clusters were counted, cut, and weighed for all vines in each replication. One hundred berry samples were taken randomly from each replication and analyzed for Brix, titratable acidity, and pH.

The Chardonnay plot was harvested on September 30, 2008. The surrounding Chardonnay vineyard was not commercially harvested. The Cabernet Sauvignon plot was harvested on October 29, 2008, and the surrounding vines were commercially harvested.

Following leaf-fall, spur positions were counted, along with stems on the vines.

Table IV
Cabernet Sauvignon frost damage management trial: TIME STUDY

Treatment	Average Time to Prune Damaged Vines (seconds)	Total Hours per Acre (projected)
Control	0 (no pruning)	0
Break Damaged Shoots	66	20
Cut Spurs	84	25.4
Cut Damaged Shoots	91	27.5

Results

In the Chardonnay trial, there were some significant differences in vine performance between treatments (at the .05 confidence interval). (Table I)

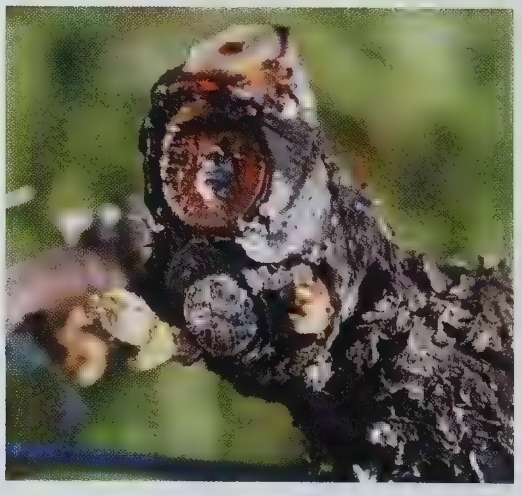
Fruit quality for the Chardonnay plot was not statistically significant between treatments. (Table II)

Shoot emergence and regrowth results from the Chardonnay plot are shown in Table III.

For the Cabernet Sauvignon plot, Table IV has the results. There were no statistical differences between treatments, but there was a definite trend toward improved yield with post-frost damage manipulations. In reviewing the statistics, the response to the treatments was quite variable, resulting in a high standard deviation for the treatments.

Fruit chemistry was not significantly different between treatments for the Cabernet Sauvignon.

Shoot emergence and regrowth from the Cabernet Sauvignon plot are shown in Table V.



Cut damaged tissue and one-year-old wood off of spur with shears, to stimulate basal buds.

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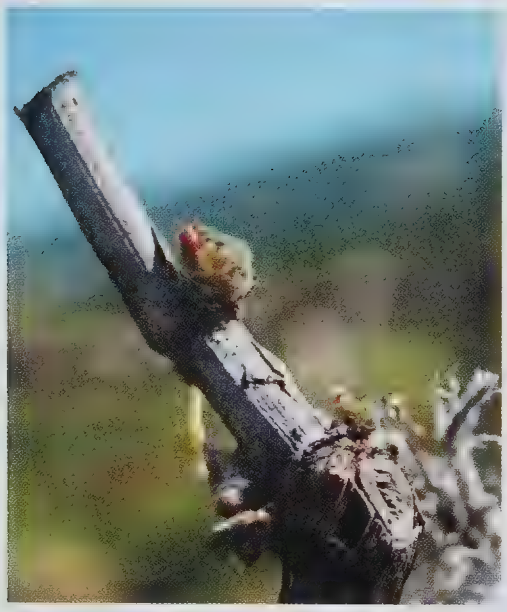


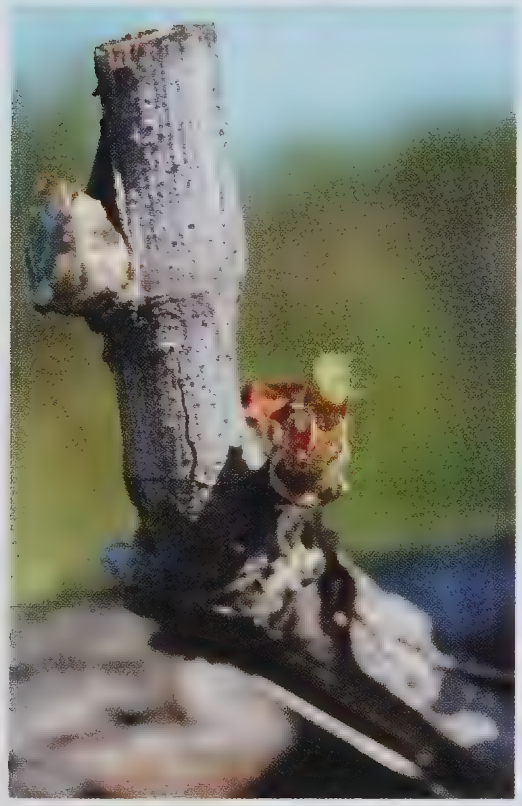
Treatment consisting of breaking damaged new growth off by hand.

Table VI shows data measured in the time study in the Cabernet Sauvignon plot.

Conclusions

Yields generally were increased by removing damaged tissue from the spurs, no matter which technique was used. In treated Chardonnay vines, the yield was significantly higher than in the control, with vines responding the most when damaged tissue was cut to the base of the shoot, but retaining a small amount of the current year's tissue. In the Cabernet Sauvignon plot, there were no significant differences between treatments, but there was definitely a trend towards higher yield when damaged shoots were trimmed.

Evidently there are bud primordia or dormant buds that then grow — there were significantly higher stem numbers on the spur positions in the treatment in which we cut damaged shoots, as well. We did not differentiate in the study



Treatment consisting of cutting damaged shoots with shears, leaving basal green tissue

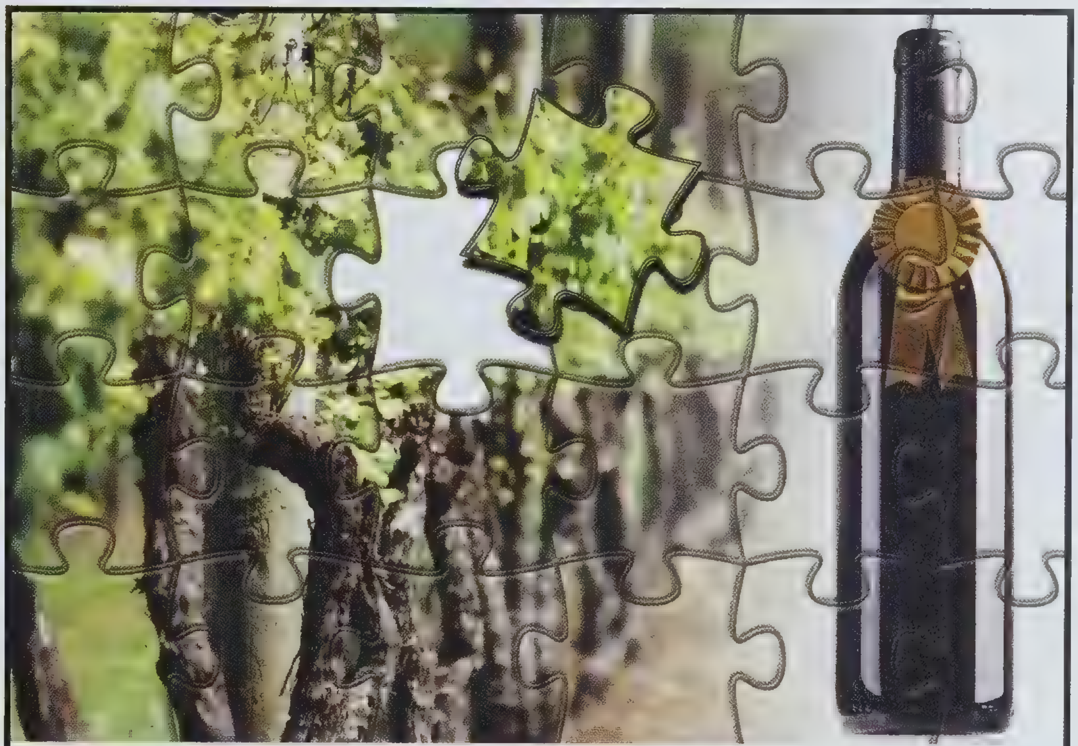


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Table V: Cabernet Sauvignon: HARVEST STATISTICS

Treatment	Avg. Cluster Weight (g)	HG*	Avg. Cluster Count	HG*	Avg. Yield/Vine (Kg)	HG*	Avg. Yield/Acre (tons)	HG*	% Change from Control
Control	54.5	a	19	a	1	a	0.86	a	—
Break Damaged Shoots	60.7	a	22	a	1.3	a	1.11	a	30%
Cut Spurs	60.4	a	21	a	1.2	a	1.03	a	20%
Cut Damaged Shoots	63.1	a	21	a	1.3	a	1.11	a	30%

Table VI: Cabernet Sauvignon: CHEMISTRY

Treatment	Berry Weight (g)	HG*	Brix	HG*	pH	HG*	Titratable Acidity (grams/100cc)	HG*
Control	0.98	a	27.0	a	3.6	a	0.73	a
Break Damaged Shoots	1.03	a	26.9	a	3.6	a	0.72	a
Cut Spurs	0.98	a	27.0	a	3.6	a	0.73	a
Cut Damaged Shoots	1.06	a	26.7	a	3.6	a	0.74	a

Table VII: Cabernet Sauvignon: SHOOT EMERGENCE AND REGROWTH

Treatment	# of Spur Positions Per Vine	HG*	# of New Shoots on Spurs	HG*	New Shoots on Cordons	HG*
Control	11	a	1.30	a	16	a
Break Damaged Shoots	11	a	1.70	a	18	b
Cut Spurs	11	a	1.80	a	18	b
Cut Damaged Shoots	11	a	3.40	b	19	B

***Values followed by the same letters are in homogeneous groups**

where the stems had actually emerged on the spur positions. Doubtless some of the shoots arose from dormant buds beneath the previous year's wood on older tissue (2+ years).

Fruit chemistry was not significantly different between the treatments. The Chardonnay sugar levels were quite low considering the time of harvest. Most of the undamaged Chardonnay blocks in the area were harvested by September 20 at much higher yields and sugars (a goal of 23.5° Brix). Even though there was some production on the vines that had been frozen, ripening was quite delayed, well below the commercial sugar content target.

The Chardonnay trial block was not commercially harvested as there was so little fruit present. By contrast, Cabernet Sauvignon grapes reached maturity in our trial, and the block was commercially harvested.

Despite the cost, most growers might do canopy manipulation after a frost specifically in order to ensure good strong wood to prune to for the following year.

Whether it makes sense to do any manipulations following freezing is questionable, and depends on the variety and need for the particular fruit. Given the extra labor expense and the relatively low yield, most growers would not see this as a cost-effective practice. The only exception might be for a particularly valuable fruit, such as a variety needed for an estate-based wine program.

The average yield of the Chardonnay block in our study is 3.9 tons per acre in most years. The average yield of the Cabernet Sauvignon block in our study is 3.6 tons in most years. The remainder of the Cabernet Sauvignon block was harvested in 2008, as the fruit is quite valuable, with a yield of 1.1 tons per acre.

This research represents only one year of data. More research is needed to see if these treatments are effective in other situations and with other varieties. We hope that opportunities to continue this work rarely occur! ■

Glenn McGourty is the UCCE Winegrowing and Plant Science Advisor for Lake and Mendocino Counties. Jim Nosera is the UCCE Mendocino County Agricultural Technician. Prahlada Papper is a UCCE Post Graduate Researcher. David Koball is the Director of Vineyards for Fetzer and Bonterra Vineyards. Chad Bordman is the Vineyard Manager for Bonterra Vineyards.

Much gratitude is expressed for the support of this study by Fetzer and Bonterra Vineyards.

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PREVIEW OF AGENDA AND KEYNOTE SPEAKERS

SUNDAY, 20 JUNE
5 PM – Welcome Wine Reception

MONDAY, 21 JUNE
8:10 AM– Climate Change – Challenge and Opportunity to Adapt/Suffer the Consequences
10:30 – VITICULTURE: Water Management – Quantity/Quality
10:30 – ENOLOGY: Acidity Management – Up or Down?
Noon – Lunch/Poster Session
1:30 PM – VITICULTURE: Grape Ripening – Dealing with Variation
1:30 PM – VITICULTURE: Innovation – From Mechanization to Automation
3:30 – VITICULTURE: Soil Management – Integrating Nutrition, Biodiversity, Carbon Sequestration, Salinity, & more
3:30 – ENOLOGY: Microbiology – Good, Bad, or Ugly

TUESDAY, 22 JUNE
8 AM – Fruit and Wine Aroma – Focusing on Objectivity
10:30 – VITICULTURE: Disease Management – Sustainability and Innovation
10:30 AM – ENOLOGY: Health Benefits and Consumer Interests
Noon – Lunch and Poster Session
1:30 PM – VITICULTURE: Canopy Management – Beyond Fruit Exposure
1:30 – ENOLOGY: Oxidation/Phenolics
3:30 – Sensory Evaluation – From Grape to Glass
5 PM – Closing Remarks, Announcing 2013 Host
5:15 PM – Poster Session/Wine Reception
7 PM – Symposium Dinner

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Organized by American Society for Enology & Viticulture Northwest Chapter

GWSS/Pierces' disease

Continued from page 29

million and covered areas in the Kern, Ventura, and Tulare counties, and Temecula and Coachella regions.

While a major portion of the funding comes from the USDA, most of that is paying just for the chemical (mostly imidacloprid) treatment and personnel to do the work. Plenty of other costs associated with the program are paid for by the state, including a network of over 50 state and country workers and, at times, private contractors who are brought in to assist. A big portion of their work is the placing, maintaining, and inspecting nearly 8,000 traps covering approximately 300,000 acres.

Fortunately, when imidacloprid went off patent in late 2005, generics became available and costs dropped, which meant a savings to the overall program.

"For most grape growers in the Central Valley, if they do not see it in their own vineyards, then it must not be a problem anywhere," says Stephen Schafer, (San Joaquin Valley winegrape grower in Madera) who understands the complacency of his neighbors while not agreeing with it. "I fully understand the importance of the area-wide program. But, I also know it is meant to be a temporary measure to hold back GWSS until science can give us a permanent way of living with Pierce's disease." ■

More details of the area-wide control programs can be found on the Internet at: www.pdgwss.net/Board_Info/AreaWide_FAQs.htm

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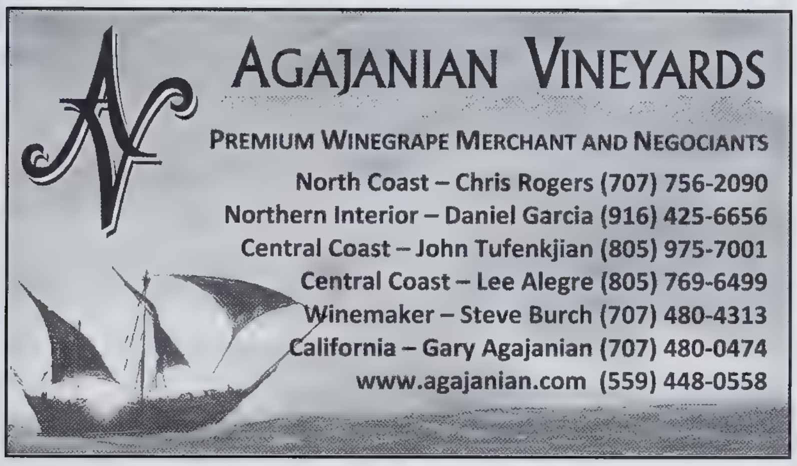

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BY Don Neel

More than 130 producers of Rhône-style wines will participate in the 18th annual Hospice du Rhône in Paso Robles, CA, (April 30–May 1), which includes a Friday Rhône Rendezvous, cooking demonstrations at Friday and Saturday tastings, a Friday evening Sommelier Soirée, Saturday Grand Tasting, and Farewell BBQ at the Paso Robles Event Center.

Event schedule

FRIDAY, APRIL 30
8 AM–9 AM — Breakfast / Check-In
9 AM — Seminar One
10:30 AM — Seminar Two
12 NOON — Rosé Lunch
3 PM–6 PM — Rhône Rendezvous
[Trade/Media 2 PM]

SATURDAY, MAY 1
8 AM–9:30 AM — Breakfast
9 AM — Seminar Three
10:45 AM — Seminar Four
12 PM–2:30 PM — Lunch + Live Auction
3 PM–6 PM — Grand Tasting
6:30 PM — Farewell BBQ

Total cost of weekend pass is $795.

Seminar Series

- Vincent Maurel of *Clos Saint Jean* and Michel Tardieu of *Maison Tardieu-Laurent*, from Châteauneuf du Pape, and consultant Philippe Cambie (named by Robert Parker as "the Michel Rolland of the Rhône").
- Charles Smith of *K Vintners* and *Charles Smith Wines* (Walla Walla, WA).
- Stéphane Ogier of *Domaine Michel and Stéphane Ogier* (Ampuis, France).
- Six South African producers: Boekenhoutskloof (Franschoek), De Trafford (Stellenbosh), Mullineux Family Wines (Swartland), Sadie Family (Swartland), Stellenzicht (Stellenbosch), and Tulbagh Mountain Vineyards (Tulbagh Valley).

HdR à la carte offerings

Rhône 'n Bowl — ($100) Thursday, April 29, 6:30 PM, Paso Robles Bowl and Grill, 2748 Spring St., Paso Robles. **(Limited Availability, attendance not included in Weekend Package.)**

Friday Rosé Lunch ($100) offers a variety of pink wines from far and wide. Chef John Toulze (**the girl & the fig** restaurant) will offer Rhône Rosé-friendly cuisine including duck confit with roasted potatoes and bacon hash.

Rhône Rendezvous Tasting ($100) Friday, 2 PM *Trade & Media Tasting (credentials required)*; 3 PM–6 PM — *Consumer Tasting*

Engage, imbibe, and savor at the world's largest international Rhône Rendezvous. Test your nose with a sensory exploration, tantalize your taste buds with a food pairing. Artisan food purveyors will be located throughout the tasting and nationally acclaimed chefs will use a new demonstration kitchen.

Sommelier Soirée — ($125) The Park Ballroom, 1232 Park St., Paso Robles

Top U.S. Sommeliers have pilfered their personal cellars to bring an exceptional array of large format bottles, Rhône wines. Look for elusive Rhône producers among the crowd. Indulge your palate with the tastes of Rhône-inspired cuisine by **the girl & the fig** restaurant, Sonoma, CA, where Sondra Bernstein (owner) and John Toulze (chef) have 13 years of experience. **Availability: attendance not included in Weekend Package.)**

HOSPICE DU RHÔNE
HdR
RHÔNELY HEARTS CLUB
April 29 - May 1, 2010

Saturday Lunch and Live Auction– ($100) Saturday 12 NOON

Raise your fork and paddle while dining on a meal paired with Rhône wines. Enjoy this unique opportunity to bid on rare, one-of-a-kind auction lots generously donated by Hospice du Rhône friends and world-wide Rhône producers. Rhône-inspired cuisine will include house-made Porchetta by **the girl & the fig** restaurant. Wines donated by Wines of South Africa.

Saturday Grand Tasting – ($100) Saturday 3 PM–6 PM

A most comprehensive tasting of Rhône variety wines, from producers from throughout the world. To complement the wines poured, artisan food purveyors will be located throughout the venue. Nationally acclaimed chefs will use a demonstration kitchen, also.

Farewell BBQ - ($100) Saturday, 6:30 PM

The annual Farewell BBQ will feature Rhône-inspired cuisine by **the girl & the fig** restaurant, to include some of the 87 recipes from ***the girl & the fig* cookbook**.

For more information, and to purchase tickets, go to www.hospicedurhone.org or e-mail: hdrinfo@hospicedurhone.org or call: 805/784-9543. ■

PRACTICAL
WINERY
& VINEYARD

March/April 2010

VINEYARD SHOWCASE

EQUIPMENT IRRIGATION SUPPLIES SERVICES GRAPE BROKERS NURSERIES

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WESTERN SQUARE INDUSTRIES

For 2010, Western Square introduces a 120-square-foot Shade Trailer for vineyard worker rest and shade. The trailer has comfortable Trex-like seating and back support for 10 to 12 people, holds two 10-gallon coolers, and can be towed by an ATV, truck, or tractor.

For more than 20 years Western Square has been a leading supplier of vineyard harvest equipment with emphasis on research, design, and product dependability.

Western Square manufactures bins, trailers, barrel cleaners, rotary washers, and barrel rack systems, including the "cave rack." Since 2005, Western Square has upgraded all manufacturing systems and processes to reflect its "Lean, Green and Made in America" approach.

In 2008, Western Square introduced the "Big Dipper," a 3-ton, self-weighing, self-dumping, narrow row trailer bin (removable) with welded steel frame, tandem axles and rotating hitch.

In 2009, the Seismic Support System — a modified barrel rack with ball bearings that allow racks to slide rather than sway during an earthquake, to avoiding barrel toppling — was added.

Western Square continues to look for innovative ways to improve its products, always with an eye to cost-effectiveness, low environmental impact, and premier research and design.

For more information, contact:
Western Square Industries
Trygve Mikkelsen
1621 N. Broadway, Stockton, CA 95205
tel: 209/944-0921; toll-free: 800/367-8383
website: www.westernsquare.com

PLEASE SEE WESTERN SQUARE AD, PAGE 51

EURO-MACHINES, INC.

Euro-Machines continues to grow as a leading supplier to North American vineyards and wineries. Euro-Machines offers the NEW HOLLAND BRAUD Grape Harvester, along with excellent customer service through an in-house service department and a network of dealers.

NEW HOLLAND BRAUD state-of-the-art technology provides top-quality harvesting and full multi-function capability. The cab on the self-propelled chassis is sealed and pressurized for noise reduction and spray safety. A multi-function lever controls all harvester functions with pre-set picking programs and multi-function attachments. Hydrostatic transmission with cruise control is standard.

The harvester head has a patented quick-shaker rod engagement; enabling activation of more or less shaker rods as the fruit zone requires. Varying leaf volumes on the vine, picking conditions, and grape varieties are easily handled by the operator viewing the picking process on a color monitor. Adjustments are just a fingertip away on the multi-function lever. Four highly efficient cleaning fans remove all leaves. For optimal cleaning efficiency, an optional patented destemmer makes it possible to destem and eliminate any MOG. The result is clean, mechanically-harvested fruit delivered to the winery.

For more information, contact:
Euro-Machines, Inc.
East: 540/825-5700; fax 540/825-5789
West: 497 Edison Ct., Ste. G
Fairfield, CA 94534
tel: 707/864-5800; fax: 707/864-5879
e-mail: info@euromachinesusa.com
website: www.euromachinesusa.com

PLEASE SEE EURO-MACHINES AD, PAGE 32

CALIFORNIA GRAPEVINE NURSERY, INC.

California Grapevine Nursery, certified by the California Department of Food & Agriculture, provides grapegrowers with high-quality planting materials. Dormant rootstock and dormant grafted vines are available at very competitive prices.

CALIFORNIA GRAPEVINE NURSERY

Choose from 21 varieties of certified rootstock including the French-developed Gravesac variety. A large selection of scion varieties and clones, including ENTAV-INRA® clones to customize a grafted-vine order, are available. California Grapevine Nursery is a licensed agent of ENTAV-INRA® material in the U.S. with authentic clones from France.

California Grapevine Nursery employs state-of-the-art nursery practices to assure clean, healthy, and productive grapevines. An integrated pest-management program is utilized to carefully monitor vines and treatments are applied only when absolutely necessary. An integrated fertilization program provides vines with proper nutrition along with preplant soil conditioning. All vines are hot water-treated at no extra charge.

California Grapevine Nursery is dedicated to providing customers with the highest quality plants available and excellent, efficient customer service.

For more information, contact:
California Grapevine Nursery, Inc.
807 St. Helena Hwy. S, Ste. 2
St. Helena, CA 94574
tel: 800/344-5688; fax: 707/963-1840
e-mail: sales@californiagrapevine.com
website: www.californiagrapevine.com

THE WINEGROWING CONSORTIUM

Dr. Paul Anamosa: Vineyard Soil Technologies
Nathan Baty: Viticultural Services
Mike Bobbitt: Mike Bobbitt & Associates
Tucker Catlin: Estate Vineyard Design & Development
Dr. Mark Greenspan: Advanced Viticulture
Dr. Daniel Roberts: Integrated Winegrowing
Dr. James Stamp: Stamp Professional Viticulture Services

After years of collaborating on vineyard design, wine quality improvements, and technical troubleshooting, these independent viticulturists have joined to provide an integrated service, to work closely with owners, winemakers, and vineyard managers to improve wine quality while achieving financial efficiency.

Clients — Consortium clients are often wineries with estate vineyards looking to improve wine quality or refocus vineyard activities and grower relations to better support winemaking/marketing goals. Quality, quantity, and costs are all considerations, with most clients in the ultra-premium and luxury categories.

New vineyards — The critical design process begins with a **site assessment** of soils, climate, topography, and wine goals. The final plan integrates blocks with soils and slopes, while selecting the best variety/clone and rootstock, spacing/row direction, and trellis/irrigation combinations. To preserve this design, **ongoing supervision** guides the process through permitting, engineering, budgeting, and into planting, training, and production.

Producing vineyards — Long-term winegrowing strategies are also applied to producing vineyards. The effects of pruning, canopy, irrigation, yield, uniformity, and ripening are all integrated to achieve winegrowing goals. For contracted fruit, extensive grower relations experience can evaluate fruit sources and match contracts or leases to winery needs. Design, supervision, and interpretation are available for viticultural experiments and weather data, where GIS maps and data management are incorporated into most projects.

For more information, contact:
The Winegrowing Consortium
tel: 707/486-6372
website: www.winegrowingconsortium.com

PLEASE SEE THE WINEGROWING CONSORTIUM AD, PAGE 55

WEED BADGER DIVISION

Thirty years of developing precision in-row rotary tillers and mowers and working factory-direct with growers has led to the release of a new Weed Badger® machine package.

The Model 4400 Weed Badger® is designed for small, fuel-efficient tractors. This new model is available with the same variety of interchangeable tines and optional tools as the Model 4200. WeedBadger® 4400 Models operate on any tractor with engine horsepower between 18 to 30 HP, equipped with a PTO, and three-point hitch with lift capacity of 840 lbs.

Wrap-around, up-front visibility, exclusive Weed Badger® ground tracking, along with precision Posi-Depth control, is standard on this model. A self-contained PTO-driven hydraulic system eliminates any concerns about tractor hydraulic capacity. Manual retract and extend is controlled with a simple joystick-operated hydraulic control. The ergonomically designed control offers a natural hands-on feel when operating. On-the-go side-to-side adjustable tilt is standard on the Model 4400.

The 4400 Weed Badger® can be purchased as a cultivator, as a mower-only machine, or as a combination cultivator/mower machine utilizing the 3875 Mower Attachment.

See the website www.weedbadger.com. Call 800/437-3392 or e-mail inquiry@weedbadger.com.

For more information, contact:
Weed Badger Division
5673 95th Ave SE, Marion, ND 58466
toll-free, USA and Canada: 800/437-3392
tel: 701/ 778-7511; fax: 701/ 778-7501
e-mail: inquiry@weedbadger.com
website: www.weedbadger.com

PLEASE SEE WEED BADGER AD, PAGE 71

DOW AGROSCIENCES LLC

New vineyard plantings should provide decades of productivity. Considering the massive undertaking and expense of planting a new vineyard, soil fumigation is strongly advised where nematodes or "replant disease" are present.

Soil fumigation using Telone® soil fumigant creates a zone of protection around roots, allowing them to develop in an environment where nematodes are controlled and soil-borne diseases and viruses (such as grape fanleaf virus) are managed. The result: extensive, healthy root systems capable of producing decades of high-quality, high-yielding grapes.

The increased growth provided by Telone® (compared to untreated) is so dramatic that the cost of fumigation is often paid for with the first crop harvested. Plus, starting vines with a healthy, strong root system leads to many other benefits such as generating early growth response, promoting plant longevity, creating more efficient use of water and fertilizer, and allowing for more rootstock choices.

Telone®

Everything grows better.™

To order the FREE guide, *Managing Nematodes and Replant Disease in Orchards & Vineyards,* call 888/395-PEST.

For more information, contact:
Dow AgroSciences LLC
9330 Zionsville Rd., Indianapolis, IN 46268
tel: 888/395-PEST
e-mail: info@dowagro.com
website: www.dowagro.com

ISAGRO USA

Isagro USA is a global discoverer, manufacturer and marketer of proprietary crop protection products in over 80 countries. For grape growers, Isagro offers a number of products including new Mettle® 125ME fungicide.

Mettle® 125ME offers pre- and post-infection control of powdery mildew in grapes. The active ingredient in Mettle 125ME is tetraconazole, which contains the "tetrafluoroethoxy" chemical group that helps provide a higher degree of systemic movement, delivering superior fungicidal performance over other triazoles. Mettle 125ME allows faster spray penetration, superior coverage, and retention characteristics for longer residual control.

Isagro also offers three high quality copper products including newly registered Badge® X_2 which contains both copper hydroxide and copper oxychloride for quicker and longer lasting control of a broad spectrum of diseases. Formulated as a dry flowable, Badge X_2 is OMRI-listed for use in organic production, and for conventional crops.

Badge® SC contains the same bio-synergistic combination of copper hydroxide and copper oxychloride in a unique and highly stable soluble concentrate formulation.

Kentan® DF is a dry flowable copper hydroxide product, consisting of biologically optimized particle sizes formulated with the highest quality co-formulants available on the market today. Kentan DF is a new standard for quality and value among copper hydroxide products.

For more information, contact:

Isagro USA
430 Davis Dr., Ste. 240
Morrisville, NC 27560
tel: 919/321-5200; fax: 919/321-5220
e-mail: info@isagro-usa.com
website: www.isagro-usa.com

PLEASE SEE ISAGRO USA AD, PAGE 7

VINTAGE NURSERIES

Vintage Nurseries is one of North America's largest producers of dormant field-grown benchgrafts. Vintage Nurseries' advanced facility provides excellent quality control. Customers receive good value, with high-quality grapevines, olive and pomegranate trees at competitive price-points. Vintage Nurseries includes hot-water-dipping on its vines, designed to eliminate vine mealybugs and other pests and pathogens, at no extra cost.

Vintage Nurseries also produces greenhouse-grown benchgrafts, rootstock rootings, own-rooted vines, and cuttings. Located in California's southern San Joaquin Valley, Vintage Nurseries propagates all plants in one of North America's best climates for a grapevine nursery.

Vintage Nurseries currently has a wide selection of popular varieties including Syrah, Pinot Noir, Cabernet, Merlot, Sauvignon Blanc, Chardonnay, and many more. Vintage Nurseries also offers new table grape releases: Scarlet Royal, Autumn King, and Sweet Scarlet, and other table and raisin grape varieties.

All customers and industry professionals are welcome to visit the facility and growing grounds.

For more information, contact:

Vintage Nurseries
Nicholas Podsakoff, No. Central Vly CA, Texas, Canada: tel: 209/456-0697
Dave Haggmark, Central coast CA, Eastern U.S.: tel: 805/391-0905
Mike Enns, South Valley wine grapes, table grapes: tel: 661/747-1582
Ken Noren, North coast CA, OR, WA: tel: 707/975-3416
Dustin Hooper, Office sales and inquiries: tel: 661/758-4777 x 421

PLEASE SEE VINTAGE NURSERIES AD, PAGE 34

KORVAN BY OXBO

Oxbo offers a full line of Korvan products for the vineyard. For 2010 and 2011, Oxbo is adding new Korvan harvesters and vineyard tools to better meet the needs and demands of today's vineyard owners.

Korvan grape harvesters have set the standard in the industry since 1999. With unique bucket conveyance and an extremely effective cleaning system, Korvan harvesters deliver the highest quality fruit without sacrificing harvesting speed or harvester capacity — Korvan harvesters harvest faster and cleaner than the competition.

Oxbo understands the importance of uptime in the vineyard. Korvan grape harvesters are backed by a dedicated local dealer network, each having a full parts inventory and specialized factory training. Every Korvan harvester is built to rigorous manufacturing standards to provide customers with long-lasting equipment that outperforms the competition, year after year.

Korvan vineyard mechanization attachments provide growers with additional ways to cut labor costs and still deliver the highest quality fruit possible.

Oxbo has continued to push the development of harvesting technologies as well as sustainable mechanized vineyard practices and continues to partner with growers, dealers, and researchers to keep the Korvan product line on the cutting edge.

For more information, contact:

Oxbo International Corp.
270 Birch Bay Lynden Rd., Lynden, WA 98264
toll free: 888/6-KORVAN;
Brent Borboa: 559/281-1883
e-mail: vineyard@oxbocorp.com
website: www.oxbocorp.com

PLEASE SEE KORVAN AD, PAGE 33

AGAJANIAN VINEYARDS

Agajanian Vineyards, wine grape merchant and bulk wine negociant, provides a variety of services to satisfy its customers' various needs.

AGAJANIAN VINEYARDS

Winery Services: Wine Grape Procurement: Agajanian Vineyards assists in finding exceptional values on wine grapes throughout California on a brokerage or full-service basis, and helps assure customers the grapes to fulfill market demand.

Grower Services: Grapes for Sale Listing: Available wine grapes are listed and, once contacted by winery clients, the Agajanian Vineyards' data base will be accessed for a match (no charge).

Grape Marketing: To find the best possible market for wine grapes, list the grapes as above, and Agajanian Vineyards will actively market the grapes by:

- Presenting grapes in a professional manner to wineries throughout North America;
- Promoting the grapes through advertising, fax, and email campaigns;
- Direct mail, telephone, and personal meetings;
- Saving customer-time finding qualified buyers;
- Giving customers market feedback;
- Assisting customers with long-term planning;

For more information, please contact:
Agajanian Vineyards
North Coast: Chris Rogers
cell: 707/756-2090
Northern Interior: Daniel Garcia
cell: 916/425-6656
Central Coast: John Tufenkjian
cell: 805/975-7001
California: Gary Agajanian
10174 Highway 41, Madera, CA 93636
cell: 707/480-0474
e-mail: gary@agajanian.com
website: www.agajanian.com

PLEASE SEE AGAJANIAN VINEYARDS AD, PAGE 57

A&J VINEYARD SUPPLY, INC.

A&J Vineyard Supply was established in May 2002 to contribute to the agricultural efforts of the Napa Valley. Today, A&J's honest approach and many hours of hard work has led to expansion of service not only in Napa Valley, but to all major grape growing regions in the U.S.

Manageable growth of the business keeps high quality control and product availability consistent. Service is the top priority at A&J Vineyard Supply. Whether a customer has 300 acres or 3 vines, A&J provides timely responses, competitive prices, realistic lead times, and the most appropriate products for each project.

A&J
Vineyard
Supply
Inc.

A&J is constantly adding to the product line. New items for 2010 include a budget-friendly line of pruning shears from Barnel International, and a complete line of olive orchard trellis materials. A&J's new, improved website and online catalog provide photos and information on the entire line of vineyard and orchard trellising supplies.

The entire team at A&J Vineyard Supply is dedicated to customer service. From the sales team to the yard crew, A&J constantly strives to set itself apart from the competition. Call or stop by the yard to experience the A&J Vineyard Supply difference.

For more information, contact:
A&J Vineyard Supply Inc.
Augusto Di Battista: 707/963-5354
Cliff Little: 707/477-9002
Antonio Zamora: 707/963-5354
900 N. Crane Ave., St. Helena, CA 94574
tel: 707/963-5354; fax 707/967-8242
website: www.aj-vineyardsupply.com

PLEASE SEE A&J VINEYARD AD, PAGE 36

RAY CARLSON & ASSOCIATES, INC.

Did you know that you could increase the profitability of your vineyard using GIS?

GIS — How can growers manage it if they haven't measured it? A Geographic Information System (GIS) ties maps to a database.

Ray Carlson & Associates have vineyard consultants (PCA) and a GIS team on staff to help:

- Organize data — and obtain vital knowledge from key personnel;
- Prepare for regulations — governmental or environmental;
- Improve management, grapes, and the vineyard team using GPS to locate critical utilities.

...Plus much more!

Mapping — Appellation custom color appellation maps, showing a winery or vineyards, are a unique marketing tool. Ray Carlson & Associates has aerial photo and mapping resources ready to create a distinct map.

Surveying — A current survey may help increase property value.

GPS — Ray Carlson & Associates uses the latest technology, but believes that high-tech will never replace high-touch.

RAY CARLSON
AND ASSOCIATES, INC.

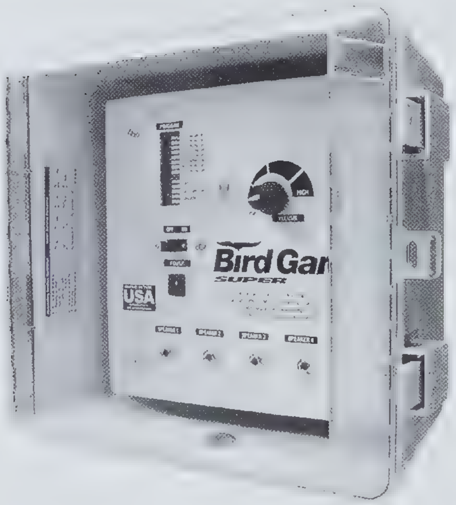
Ray Carlson & Associates combines a variety of high-quality products with dedication to customers and their needs, and have been surveying and mapping land in Sonoma County and surrounding California counties since 1976.

For more information, contact:
Ray Carlson & Associates, Inc.
411 Russell Ave., Santa Rosa, CA 95403
tel: 707/528-7649; fax: 707/571-5541
e-mail: rca@rcmaps.com
website: www.rcmaps.com

PLEASE SEE RAY CARLSON & ASSOCIATES AD, PAGE 26

BIRD GARD, LLC

"Bird Gard" electronic bird repelling products drive unwanted birds away from vineyards, orchards, crops, airports, landfills, and anywhere birds are a problem. Audible bird distress and harassment sounds are digitally recorded onto a microchip and are effective against starlings, robins, grackles, seagulls, woodpeckers, and other pest birds. These sounds are then amplified and broadcast to protect areas from one acre (0.4 hectares) up to 30 acres (12 hectares).



The new Bird Gard Super Pro PA 4 introduces fully-digital random operation throughout, and is designed to use low frequency sounds to drive away wild turkeys, deer, heron, egrets, and other mammals, protecting up to six acres. Bird Gard products include a one-year customer satisfaction guarantee. Manufactured in the U.S.A.

Bird Gard® LLC

For more information, contact:
Bird Gard, LLC
PO Box 1690, 254 West Adams Ave.
Sisters, OR 97759
tel: 541/549-0205; toll-free: 888/332-2328
fax: 541/549-5286
e-mail: info@birdgard.com
website: www.birdgard.com

KINSEY AGRICULTURAL SERVICES, INC.

Nutrient management and development for rebuilding vineyard soil quality

You can't manage what you can't measure. This program is especially designed to correctly define, measure, and **manage vineyard soil fertility.**

Specific tests are utilized to measure, map for sampling, and analyze vineyard soils. The program is designed to determine nutrient requirements for every significant variation in the soils of each vineyard utilizing **detailed soil tests** combined with **optional GPS technology**. By determining the subtleties of each soil and consequences for grapes from **nutrient deficiencies or excesses, potential advantages and/or problems** can be identified and appropriate solutions proposed.

The process focuses on required nutrients and **changes** in **soil quality** to provide the proper environment and encouragement for **biological aspects** of the soil. Correcting soil chemistry **increases rooting** and improves soil porosity. This provides a better balance of water, air, and nutrients that encourages and builds biological life in the soil with the long-term goal of correcting the soil's physical structure. Specialized **soil evaluation and recommendations** help avoid potential problems from applying too little or too much. This helps benefit both vine and grape quality, and resulting wines.

On-site consultations can be arranged to help establish, achieve, and maintain goals in terms of correctly building up natural soil quality.

Training programs help to clarify soil fertility requirements. Scheduled courses for soil building and maintaining vineyard fertility are posted at www.kinseyag.com.

For more information contact:
Kinsey Agricultural Services, Inc.
297 Co. Hwy. 357, Charleston, MO 63834
tel: 573/683-3880; fax: 573/683-6227
e-mail: neal@kinseyag.com
website: www.kinseyag.com

DAVIS VITICULTURAL RESEARCH

Davis Viticultural Research (DVR) has more than 30 licensed growers in 12 states from coast to coast. DVR is devoted exclusively to breeding and selling new, patented grape varieties and to assist in creating a market for this new family of vines. It is a privately-owned corporation, not affiliated with any educational or government institution.

All DVR vines were bred and developed in Davis and Winters, California. They have been field-tested in northern and southern California, central Missouri, and western Illinois.

All DVR vines share a common parent: Norton, (a.k.a. Cynthiana or Virginia Seedling). The DVR research and breeding program has yielded a dozen outstanding new vines — an entirely new family of fine wine grapes.

All DVR vines are Norton-crossed with a pure *vitis vinifera* parent. DVR has developed crosses from Cabernet Sauvignon, Zinfandel, Malbec and other outstanding *vinifera* from Spain, Italy, Portugal, Hungary, and the Middle East.

Norton is a cross of *vitis cinerea* and *vitis vinifera*, giving all DVR vines a gross *vinifera* percentage of 75%.

DVR vines are not French hybrids, nor related in any way to French hybrids, nor share any of the flavor profiles of French hybrids.

For more information contact:
Davis Viticultural Research
RR2, Ste. 207, Carrollton, IL 62016
tel: 618-946-3517
e-mail: Walt500@aol.com
website: www.davisvines.com

PLEASE SEE DAVIS VITICULTURAL AD, PAGE 57

JIM'S SUPPLY COMPANY, INC.

Jim's Supply Company is the nation's largest full service supplier, manufacturer, and distributor of vineyard and orchard trellising materials. Jim's Supply has been serving the industry since 1959 and celebrated its 50th anniversary in 2009.

With three fully-stocked and professionally-staffed locations, along with a fleet of 20 trucks, Jim's Supply is equipped to meet all needs. A unique manufacturing process allows Jim's Supply to remain a leader in price point and overall quality, setting them ahead of the competition. Jim's team consists of vineyard experts with an average of 16 years of experience in the industry.

Jim's Supply not only carries materials needed, but can design a system to meet vineyard needs, and then fabricate the order inside its manufacturing plant. Jim's Supply is a "go-to" supplier for hard-to-find items, and an industry leader in saving customers time and money.

From the West to East Coast of North America (Mexico and Canada, too), Jim's Supply is a leading supplier for all vineyard needs. Local delivery and nationwide shipping are available.

For more information, contact:

JSC
Jim's Supply Co., Inc.

Jim's Supply Company, Inc.
Corporate Office/Manufacturing
3530 Buck Owens Blvd., Bakersfield, CA 93308
toll-free: 800/423-8016; tel: 661/324-6514
fax: 661/324-6566
e-mail: info@jimssupply.com
website: www.jimssupply.com
Northern CA/Southern OR
4102-A St. Helena Hwy., Calistoga, CA 94515
tel: 707/942-JIMS (5467); fax: 707/942-9752
Central CA/San Joaquin Valley
Mike Gostanian, cell: 559/930-6165
Central CA/Monterey and Coastal
Dan Drake, cell: 661/303-2080
office: 800/423-8016
Pacific NW/Washington Depot
8148 Stateline Rd., Touchet, WA 99360
Doug Case, cell: 509/781-0898

PLEASE SEE JIM'S SUPPLY CO. AD, PAGE 73

BEVILL VINEYARD MANAGEMENT

Bevill Vineyard Management (BVM) was established in 1975 with a small crew and a dedication to integrity, accountability, and excellence. Today the company manages 1,100 acres with 125 skilled workers.

A progressive farming company, BVM combines science with pragmatic and environmentally sound farming. Using modern technology to collect and analyze data, BVM creates a unique management and financial plan for each vineyard, maximizing site potential. BVM can develop property on a vine-by-vine basis, and identify distinctive blocks for luxury wine products. BVM grows the highest quality wine grapes, and delivers pristine fruit at peak maturity to more than 40 wineries throughout Sonoma and Napa counties.

Individual site development, custom vineyard, and estate projects services include:

- Land evaluation for vineyard potential, development and planning;
- Land preparation including permits;
- Land clearing, grading, engineering, design;
- Subsoil ripping, plowing and drainage;
- Irrigation design and development
- Variety, clone, and rootstock selection
- Trellis design, planting, labor, and equipment;
- Pre-plant grape contract negotiation.

Management services with a comprehensive annual agreement include:

- Complete turnkey management of property and vineyards;
- Integrated pest management field monitoring;
- Riparian habitat and creek restoration;
- Providing all labor and farm equipment for vineyard operations.

BVM provides a supplemental grape marketing service for client vineyards.

For more information, contact:

Bevill Vineyard Management, LLC
4724 Dry Creek Rd., Healdsburg, CA 95448
tel: 707/433-1101; fax: 707-433-3253
e-mail: info@bevillvineyard.com
website: www.bevillvineyard.com

PLEASE SEE BEVILL VINEYARD MANAGEMENT AD, PAGE 27

TURRENTINE BROKERAGE

Turrentine Brokerage sells winegrapes from all California regions, and wines in bulk from California and around the world. Turrentine Brokerage delivers customized solutions for growers, wineries, and investors based on:

- A reputation for integrity earned over 37 years of service;
- Quick response to client needs;
- Demonstrated expertise, with the most experienced team of brokers and analysts in the industry — over $1.5 billon dollars in completed grape and wine transactions over the last ten years;
- Proven long-term strategies from exclusive and superior market information, and proprietary research;
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Turrentine Brokerage
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Michael Robichaud, Broker/Partner
Brian Clements, Senior Partner
Larry Kavanagh, Broker
Erica Moyer, Broker/Partner
Bill Turrentine, President/Partner
Matt Turrentine, Broker
Steve Robertson, Broker/Partner
Stephens Moody, Broker
Audra Cooper, Broker
7599 Redwood Blvd. Ste 103, Novato, CA 94945
tel: 415/209-9463; fax: 415/209-0079
e-mail: info@turrentinebrokerage.com
website: www.turrentinebrokerage.com

PLEASE SEE TURRENTINE BROKERAGE AD, PAGE 13

SUNRIDGE NURSERIES, INC.

Sunridge Nurseries, Inc., a full-service nursery, has been providing top-quality grape nursery stock to the wine and table grape industries for 33 years. Many different varieties and clones grafted on a choice of rootstock are available; material is hot water-dipped to ensure pest-free, high-quality vines.

Sunridge is an official ENTAV licensee. 2010 introductions include: Aligote 651, Biancu Gentile Blanc 988, Clairette Blanc 208, Grenache Noir 287, Mourvedre 247, and Tannat 717.

SUNRIDGE® NURSERIES
Where the vintage begins

Sunridge Nurseries offers an affordable plant protector to protect young vines from herbicide sprays, small animal feeding, and wind damage. For dormant vines, the top of the plant protector can be closed to simulate a greenhouse environment that enables vines to push buds without drying out. Once the roots take hold and the vine buds push, the plant protector can be opened or unsealed quickly (no shovel required) to simulate a grow tube. Costly mounding expenses are avoided.

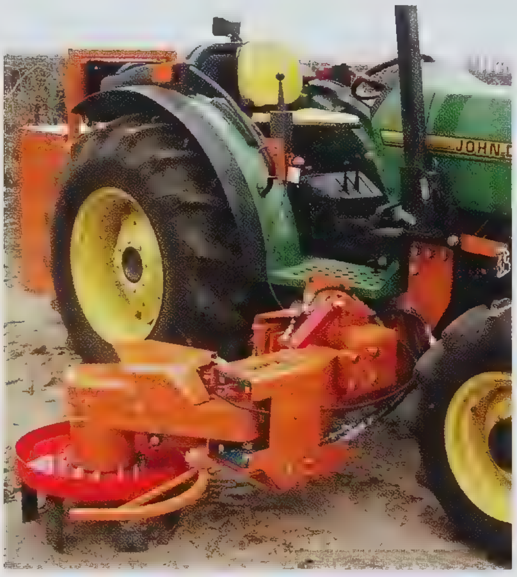
Contact Sunridge Nurseries today!

For more information, contact:
Sunridge Nurseries, Inc.
North Coast Field Rep: Michael Monette
tel: 707/975-3646; vineguy@sonic.net
Central Coast/Washington State Field Rep: Andrew Jones tel: 805/234-4920;
grapevinejones@gmail.com
Oregon State Sales Representative:
Ted C. Thompson tel: 503/886-9356;
ted@sridge.net
Central Valley/ Temecula and Table Grapes Field Rep: David Mann tel: 661/978-5696;
dmann@sridge.net
Northern Interior/Out of State Field Representative
California Grapevine Nursery
(Sunridge Nurseries affiliate):
Ernie Ilsley: tel: 707/947-2642
ernie@californiagrapevine.com
441 Vineland Rd., Bakersfield, CA 93307
tel: 661/363-8463; fax: 661/366-4251
website: www.sunridgenurseries.com

KIMCO MFG., INC.

Kimco Manufacturing has an answer to reduce the cost of controlling in-row weeds. The Kimco Model 9300 is a heavy-duty in-row tiller that operates in virtually any vineyard. It can remove weeds — including just-sprouted and those that have grown up into the vine canopy. The Kimco 9300 works well under extreme conditions, and is gentle on young vines.

Designed specifically to work under drip lines, the Kimco 9300 works in soil conditions that other machines cannot, from sand to clay to rocks in virtually any combination. It does all this more effectively and at a lower cost per acre than chemical weed control.



The Kimco is always mounted ahead of the operator for best visibility and operator convenience. The operator has fingertip control of all machine functions. The automatic vine sensor can easily be overridden by the operator, and the tilling depth can be adjusted on-the-go.

With many years of proven durability, the Kimco Model 9300 in-row tiller and its companion, the Kimco M-9700 in-row mower, have proven to be very cost-effective devices to mechanically control in- row weeds.

For more information, contact:
Kimco Mfg., Inc.
9200 W. Barstow Ave., Fresno, CA 93723
tel: 559/277-9300 or 800/356-9641
fax: 559/277-9358
e-mail: sales@kimcomfg.com
website: www.kimcomfg.com

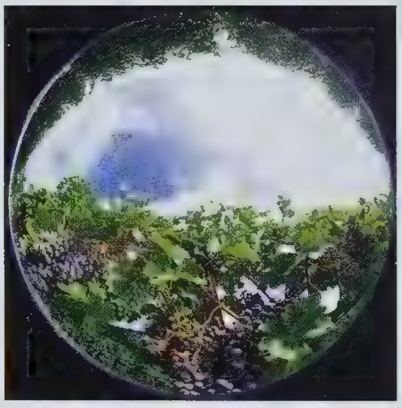
PLEASE SEE KIMCO MFG. AD, PAGE 44

VITICISION

Grow higher quality grapes with better yield.

Viticision works hand-in-hand with growers to solve vineyard management problems, providing temperature and exposure data for informed decisions on grape development. Vineyard managers can view heat loads during the current season, or analyze past and future scenarios.

Viticision's "Grapes Eye View" model offers hourly grape temperatures, sunburn and frost mapping, trellis retrofit, and vineyard development. The model can show the difference between reported air temperature and actual temperature of grape clusters on either side of the trellis, within a given vineyard block or sub-block. It requires minimal hardware and performs within 2–3°F (1–2°C) accuracy, giving the real degree hour loads above and below critical temperatures.



Hemispherical photography calculates canopy geometry and/or solar radiation.

Viticision works with growers to build custom grape maturity models to determine the temperature profile in each block that provides the highest quality fruit with minimum damage. This tool enables winegrowers to define the optimal grape maturity for grape development and wine production.

Viticision delivers custom reports and analysis. Applications include: bud fertility analysis, improved light environment, flavor retention, "what if" analysis, potential trellis retrofits, new vineyard design, cover crop analysis, mildew models, and disease control.

For more information, contact:
Viticision
27 Bishop Ln., Menlo Park, CA 94025
tel: 650/270-9861; fax: 650/644-3355
e-mail: carrieanne@viticision.com
website: www.viticision.com

PWV BOOKSHELF

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Our wine books promptly shipped from one source.

TECHNIQUES & CONCEPTS LAB BOOKS

Chemical Analysis of Grapes and Wine: Techniques and Concepts
P. Iland, N. Bruer, G. Edwards, S. Weeks, & E. Wilkes
Comprehensive theory and practice of major chemical analyses of grape and wine.
120pp—$120

Monitoring the Winemaking Process from Grapes to Wine: Techniques and Concepts
P. Iland, N. Bruer, A. Ewart, A. Markides & J. Sitters
Concepts, tests and techniques used by winemakers throughout the winemaking process for wine style and quality control. **115pp—$120**

Microbiological Analysis of Grapes and Wine: Techniques and Concepts
P. Iland, P. Grbin, M. Grinbergs, L. Schmidtke, & A. Soden
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Cooperage for Winemakers
Geoffrey Schahinger, Bryce Rankine
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Sturdy, laminated, pocket-sized guide containing more than 350 color photos with short, easily-read descriptions of most diseases, pests, and disorders.. **107pp—$30**

Micro Vinification
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A practical guide for home winemakers, commercial small-scale producers, and large wineries making small, experimental lots of table wine. **120pp—$36**

Soil, Irrigation & Nutrition
P. Nicholas
Describes vineyard soil types, how to manage soil treatments, cover crops, and herbicides, optimize water quality, irrigation systems; also nutrient deficiencies and toxicities and how to manage nutritional requirements.
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Sunlight into Wine
R. Smart & M. Robinson
Canopy management and economics, improvement of canopy microclimates, importance of winegrape canopies, construction of trellis systems. **88pp—$40**

Vineyard Simple
Tom Powers
Provides a clear outline with diagrams and color photos on how to build and maintain your own vineyard. **118pp—$20**

Viticulture, Vol. I — Resources
B.G. Coombe & P.R. Dry
Resources in Australia but with worldwide application. Soils, climates, grapevine classifications, grape varieties, phenology, rootstocks, planting material, vineyard site selection, and grape berry development are discussed. **211pp—$60**

Viticulture, Vol. II — Practices in Australia
B.G. Coombe & P.R. Dry
Grapevine propagation, vineyard establishment, pruning, canopy management, irrigation, grapevine nutrition, grape pests, disease, and protection. **384pp—$60**

NEW!
Wine Grape Production Guide for Eastern North America
Natural Resource, Agriculture, and Engineering Service (NRAES)
Information includes site selection and preparation, trellising and pruning, disease and pest identification, nutrient management, irrigation, pesticide application, harvesting, vineyard cost and returns, and grape sales.
300+pp—$75

Winegrape Berry Sensory Assessment in Australia
E. Winter, J. Whiting, J. Rousseau
How to examine berries before harvest with 20 standardized and industry-tested criteria, by judging stems, skins, pulp, and seeds.
64pp—$30

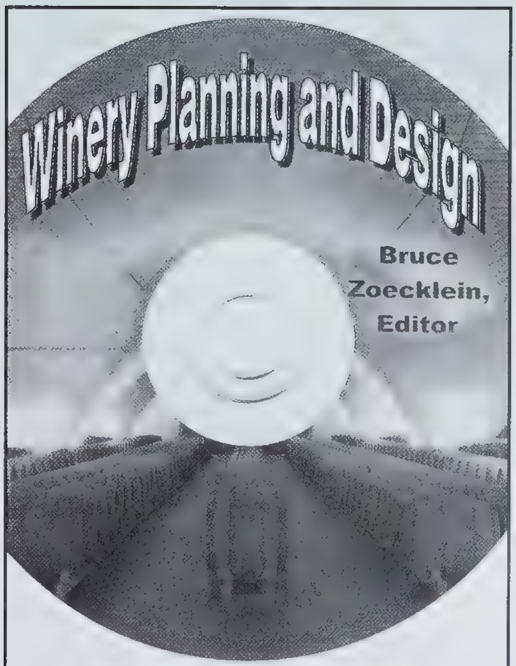
A Zinfandel Odyssey
Rhoda Stewart
100 interviews with Zinfandel and producers throughout California and Mexico. Edited and published by *PWV*. **450pp—$40**

COOL CLIMATE BOOKS

Production of Grapes and Wine in Cool Climates
David Jackson, Lincoln University, New Zealand and Danny Schuster (NZ vintner)
Includes major world cool climate regions, all aspects of vineyard establishment and practices, and winemaking from cool climate grapes. First printed 1981. Latest updated printing, 2007.
193pp—$55

Monographs in Cool Climate Viticulture I: Pruning and Training
David Jackson, Lincoln University, New Zealand
New approaches to analysis and interpretation of pruning and training that apply to specific benefits and challenges of cool climates.
169pp—$30

Monographs in Cool Climate Viticulture II: Climate
David Jackson, Lincoln University, New Zealand
Importance of climate for growing grapes and producing wine in cool temperatures, and how growers can avoid potential problems. Topics include world climates and global warming, vineyard establishment in cool climates, and wine styles. **80pp—$35**



NEW 16th Edition Now Available!

A comprehensive work on CD which covers basic essentials of planning and designing a winery.

The latest edition provides access to five hours on sustainability (Adobe Presenter) and includes architecture layouts with examples.

Topics include:

- Winery Business Planning
- Winery Economics
- Winery Design
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- Winery Legal Issues
- Winery Refrigeration
- Winery Water Requirements
- Winery Wastewater Treatment
- Winery Laboratory
- HACCP Planning
- Sustainability

The CD is exclusively available from **PWV Bookshelf for $110.**

LAKE COUNTY GRAPEVINE NURSERY

Lake County Grapevine Nursery is tucked away at an isolated valley location, the northernmost of California's grapevine nurseries, producing healthy, disease-free vines for discerning, value-focused customers.

LCG Nursery is home to 250 acres of well-drained sandy loam for the production of dormant benchgrafts and rootings. The LCG Nursery property includes impressive and well-maintained greenhouses, a robust production facility, and cold storage space.

The high elevation provides a cooler climate in the fall and early winter months, exposing the vines to low temperatures, which guarantees exceptional dormancy and disease control, especially Pierce's disease.

LAKE COUNTY GRAPEVINE
NURSERY OPERATIONS
Where your success takes root

LCG Nursery offers growers a selection of grape varieties, clones, and rootstocks as dormant benchgrafts, potted green-vines or rootings, and own-rooted material.

LCG Nursery is a family-run, full-service nursery with the best facilities and equipment available, plus customer care, attention, and dedication to personal service.

For more information, contact:
Lake County Grapevine Nursery
4887 New Long Valley Road
Clearlake Oaks, CA 95423
tel: 707/998-9674
website: www.lcgn.net

QUIEDAN COMPANY

Quiedan Company designs, manufactures, and distributes trellis systems and related products. Quiedan has designed and tooled several steel trellis profiles and casings, injection-molded and extruded plastic profiles, and parts that have received widespread acceptance.

Quiedan's in-house engineering and shop are well qualified to design and build prototypes of a variety of products, components and parts which can be tested and speedily put into production. The manufacturing capabilities for punching and roll-forming, coupled with materials selection, are unparalleled in the vineyard industry.

Quiedan's broad experience in sourcing assures competitive prices for products made in-house, domestically, or offshore. Innovation, design, engineering, and experience provide the capability to develop systems from the ground up, or to retrofit existing systems in need of improvement.

Quiedan offers comprehensive product lines, a commitment to innovation and improvement, and many years of experience and success.

For more information, contact:
Quiedan Company
15400 Meridian Rd., Salinas, CA 93907
tel: 831/663-0770; fax: 831/663-0777
website: www.quiedan.com

PLEASE SEE QUIEDAN AD, PAGE 57

TERRA SPĀSE, INC.

Terra Spāse provides state-of-the-art technical solutions to climate and soil-based problems for existing and new vineyard development projects, including an extensive archive of high-resolution historical climate data for California's North Coast, weather and disease (mildew and botrytis) risk maps for Napa and Sonoma counties, vineyard-specific measurements of vine water and soil moisture status, and NDVI canopy density maps.

SOIL CARBON CONTENT maps for Napa, Lake, and Mendocino county appellations are now available. The data is important for determining the potential for carbon sequestration of atmospheric CO_2 in agricultural lands, reducing carbon emissions, and calculating offsets used in a cap and trade system.

Terra Spāse can provide a SOIL SUSTAINABILITY ANALYSIS based on the latest USDA soil models, measuring soil erosion, fertility, rooting depth, available water holding capacity, soil organic carbon and more.

Terra Spāse has performed a VINEYARD SUITABILITY ANALYSIS for Lake and Mendocino counties using the latest soil, climate, and geospatial modeling techniques, and offers suitability maps for wine grape appellations in both counties.

Terra Spāse™
your map to fine wine

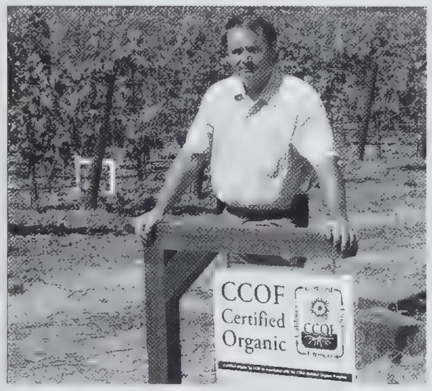
Soils and Wine Grapes in the Napa Valley (233 pages with 137 color maps) and *Weather and Wine Grapes in the Napa Valley AVA* (183 pages with 93 color maps) can be ordered for the combined price of $250. The books are a valuable resource for vineyard owners/manager, winery owners/general managers, winemakers, and those concerned with climate change possibilities.

For more information, contact:
Terra Spāse, Inc.
345 La Fata St., Ste. D, St. Helena, CA 94574
tel: 707/967-8323; fax:707/967-8596
e-mail: info@terraspase.com

PLEASE SEE TERRA SPASE AD, PAGE 24

JACK NEAL & SON VINEYARD MANAGEMENT

Serving Napa, Sonoma, and the surrounding counties since 1968, Jack Neal & Son (JNS) is ready to meet all vineyard management and related needs. Services offered include: feasibility studies, vineyard development, replanting and varietal conversion, viticultural consulting, pesticide application, labor contracting, hand and mechanical harvesting, grape and wine brokering, hauling of grapes/juice/wine/barrels/equipment, GIS mapping and analysis, full farm mechanic shop services, mobile equipment repair, metal fabrication and OSHA/worker safety training.



JNS has provided ultra-premium wine grape growing services for more than 40 years, and continues to be at the forefront of the industry by looking ahead to new tools and techniques. JNS was an early adopter of several new technologies in multi-spectral imagery, weather analysis, and precision agriculture, and is taking a leading role in the application of biodynamic and sustainable farming practices.

JNS has been at the forefront of the organic movement, practicing organic farming since 1984 and currently farming 95% of the vineyards under its care organically. JNS is Napa's specialist in converting a vineyard from conventional to CCOF certified organic farming, having converted more Napa vineyards to certified organic farming than any other vineyard management company.

For more information, contact:
Jack Neal & Son Vineyard Management
360 La Fata St., St. Helena, CA 94574
tel: 707/963-7303; fax: 707/967-3542
e-mail: info@jacknealandson.com
website: www.jacknealandson.com

CENTRAL VALLEY BUILDERS SUPPLY

Central Valley Builders Supply (CVBS) opened its doors in 1955 to supply building materials to surrounding builders. Since then, CVBS has grown into one of the largest suppliers of vineyard products and irrigation supplies in the industry, supplying customers in wine country, throughout the U.S., and abroad.

CENTRAL
VALLEY
BUILDERS SUPPLY
AGRICULTURAL DIVISION

The CVBS Agricultural Division carries a large assortment of trellising, fencing, irrigation, drainage, erosion control, pruning, spray, Macrobins, harvest supplies, and much more. Visit the website, www.cvbsupply.com, for a complete list of suppliers and links, or call one of the three locations.

CVBS opened its fifth location (third store focused on ag products) in Healdsburg in 2006. Healdsburg is a 10,000 sq ft. store with a 1.5-acre materials yard, designed around everything an agricultural or vineyard customer would need.

As CVBS expands into new territories, the commitment continues to be the same: A total vineyard supplier that is responsive, flexible, and creative in solving customer needs. With a distribution facility and a fleet of delivery trucks, CVBS Ag Division has the materials customers need, with the ability to deliver the product where customers need it most, on the job, and on time. To schedule a call or jobsite visit by a sales professional, contact CVBS.

For more information contact:
Central Valley Builders Supply
1100 Vintage Ave., St. Helena, CA, 94574
tel: 707/963-3622; fax: 707/963-8952
1790 Soscol Ave., Napa, CA, 94559
tel: 707/257-8888; fax: 707/261-2962
160 Grant Ave., Healdsburg, CA, 95448
tel: 707/473-9722; fax: 707/473-9688

KENDALL-JACKSON NURSERY

Kendall-Jackson Wine Estates raised the bar of nursery quality when it opened an in-house nursery to customers throughout the industry. "The Madera, CA nursery has become one of the nation's largest grapevine resources since opening in 1993," says Ernie Bowman, nursery general manager.

"We do things our own way from start to finish because we are so focused on — maybe even a little obsessed with — quality," he adds. "Our quality is second to none in the industry."

The nursery has prized scionwood cuttings from some of California's choicest vineyards, including those on Mt. Veeder in Napa County, and Alexander Mountain Estate in Sonoma County.

One key to quality at the nursery is a trellised rootstalk block. Trellising, the exception rather than the rule at most nurseries, gets the rootstalk off the ground for ideal sun exposure, reduces pest and fungus pressures, and encourages straight cuttings for grafting.

Vines are custom-cultivated to meet various requirements in terms of disease resistance, vigor, and drought tolerance. Dormant benchgrafts, dormant rootings, green benchgrafts, and green quick-starts are available. The nursery accepts custom orders and offers free delivery for orders of more than 10,000 vines.

Additional information about the nursery and its products is available at the Kendall-Jackson website: www.kj.com.

For more information, contact:
Kendall-Jackson Nursery
Ernie Bowman, General Manager
1190 Kittyhawk Blvd., Santa Rosa, CA 95403
tel: 707/836-2021; fax: 707/836-2266
website: www.kj.com

PLEASE SEE KENDALL-JACKSON NURSERY AD, PAGE 31

SPEC TRELLISING

Spec Trellising, a family-owned and operated trellis supply company, works closely with customers to meet their needs with high-quality trellis materials and trellis-related products at reasonable cost, with first-rate service.

Spec recommends only top-quality, long-lasting trellising materials for grapevine trellising. While lower-quality products can undoubtedly be found, it is Spec's sincere belief that trellis construction is a laborious, costly task that should be done right the first time, using only the finest products. Research indicates that good, sound canopy management is critical to formation of high-quality fruit, and begins with proper materials.

SPEC TRELLISING

Spec's diversified product line includes everything grapegrowers need to trellis and train vines, and to manage canopies. The company's products are among the best of their kind in the world, and include steel posts, hi-tensile wire, vine shelters, bird netting, vine-tying products, and more.

Spec Trellising offers the highest quality bird netting. Net types include single-row and multi-row drape-over nets along with several types of side netting. All nets are knitted and carry a 10-year UV warranty.

For more information, contact:
Spec Trellising
39 Indian Dr., Ivyland, PA 18974
tel: 800/237-4594, or 215/322-5588
fax: 215/357-3122
e-mail: info@spectrellising.com
website: www.spectrellising.com

PLEASE SEE SPEC TRELLISING AD, PAGE 49

SUREHARVEST, INC.

SureHarvest Farming MIS is a powerful software tool to increase efficiency, conserve resources, cut costs, and improve quality by providing growers with access to data to make better-informed and more timely farming management decisions. With SureHarvest Farming MIS, growers can plan, schedule, record, analyze, and report all vineyard activities including scouting; sampling and food safety; chemical-fertilizer applications; irrigation; yield forecasting; harvest, and labor.

SureHarvest MIS has six activity-based modules that can be purchased as a system or separately. Growers can track labor, equipment and materials costs to the block and subdivision level with the Labor and Resource Management module. With Farming InSight, the data can be overlaid onto a GIS map of vineyards, providing managers with timely decision-analysis reports using a web browser.

SureHarvest
SUSTAINABILITY FROM THE GROUND UP

Since 1999, SureHarvest has been a leading provider of sustainability software and consulting services to the California wine industry. SureHarvest was a key architect of the California Code of Sustainable Winegrowing Workbook, assisting 1,500+ growers and vintners to evaluate their vineyards and wineries according to 227 sustainability practices. The SureHarvest Sustainability MIS offers collection of data and benchmark reporting, and powers the Sustainable Winegrowing Program. SureHarvest also manages the *Protected Harvest* eco-certification program, used by Lodi Rules.

For more information, contact:
SureHarvest, Inc.
2901 Park Ave., Ste A2, Soquel, CA 95073
tel: 831/477-7797; fax: 831/477-7790
e-mail: sales@sureharvest.com
website: www.sureharvest.com

ADVANCED AGRICULTURAL SERVICES, INC.

Advanced Agricultural Services are available for advanced agricultural needs.

Throughout central California, a team of expert consultants assists growers and management companies with tasks from conventional integrated pest management to augmented biological infusion programs.

The goal of Advanced Agricultural Services is to develop and implement programs that improve a grower's bottom line. Advanced Agricultural Services serves vineyard owners with as much diligence as vineyard owners give their crops.

Services offered for conventional and organic crops include:

- IPM specialists;
- Pest and disease consulting;
- Grape fruitfulness inspection (Bud Analysis);
- Biological infusion programs;
- Nutritional monitoring and advice;
- Research and development.

For more about Grape Bud Analysis, go to www.advancedagriculturalservices.com/grapebuds.html. See "What causes a bud to produce a bunch or not?" ***PWV***, November/December 2009.

Advanced Agricultural Services' experts work with all California crops and design programs based on specific needs. After a free consultation, an action plan is developed outlining measurable and meaningful goals that are set into action and monitored on a regular basis.

For more information, contact:
Advanced Agricultural Services
17459 – 10th Ave., Hanford, CA 93230
office: 559/582-5402; fax: 559/584-1553
Donald Thomas: 559/309-3866
e-mail: info@advancedagriculturalservices.com
website: www.advancedagriculturalservices.com

SPRAY INNOVATIONS BY SWIHART SALES

Spray Innovations offers a line of low volume mist blowers to match practically any spraying need.

With low volume spraying, the overall volume and chemical usage can be considerably reduced compared to conventional spraying. The sprayers, using air as the carrier, deliver a fine mist in a swirling action to totally engulf the target area.

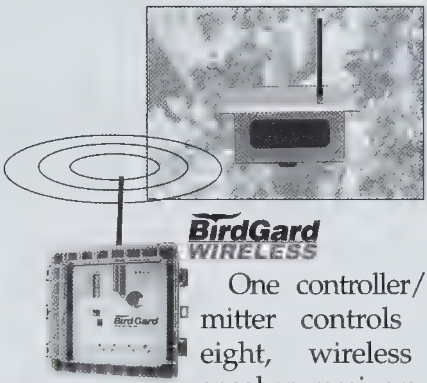
Spray Innovations sprayers are built strong with all steel framework, powder coat paint, galvanized fan, poly tank, and are made in America. Spray Innovations offers several PTO models and self-propelled models.

For more information contact:
Swihart Sales Company
(owner and distributor)
7240 CR AA Quinter, KS 67752
tel: 800/864-4595

PLEASE SEE SWIHART SALES AD, PAGE 57

BIRD GARD/JWB MARKETING LLC

Bird Gard SuperPRO with wireless speakers broadcasts distress calls 1000 feet in any direction. Sounds "jump" from speaker to speaker on each four-speaker receiver, keeping the birds flying for better long-term bird control.



One controller/ transmitter controls up to eight, wireless four-speaker receivers. That's up to 48 acres of bird control with eight different programmable distress and predator calls.

Each controller/transmitter includes one four-speaker receiver protecting up to six acres from bird damage. Additional four-speaker receivers are $350. One system can be customized to protect 6, 12, 18, 24, 30, 36, 42, or 48 acres.

For more information, contact:
Bird Gard/JWB Marketing LLC
Jim Burton
2308 Raven Trail, West Columbia, SC 29169
tel: 800/555-9634; fax: 803/796-0654
website: www.birddamage.com

DUARTE NURSERY, INC.

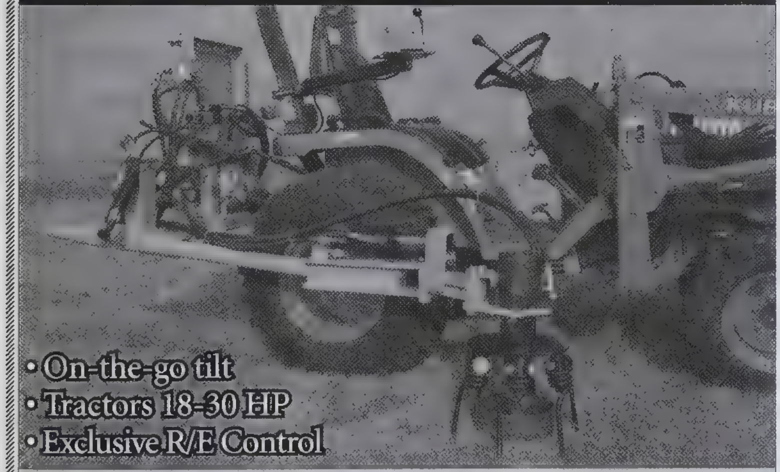
Duarte Nursery introduces the 42-inch Ubervine — a bigger, stronger vine for vineyards. The bench-grafted Ubervine utilizes an extra-long rootstock cane and a proportionally larger pot, and when planted, it can be tied directly to the training wire. Vineyard managers can save money on vine protectors and installation, and see cost savings in first-year training.

Duarte offers one of California's best vineyard service teams. A Duarte viticulture consultant is available to provide sales and service throughout California and Oregon grape growing regions.

Duarte Nursery, Inc. (DNI) is a family owned and operated nursery located near Modesto in the Central Valley of California. DNI is the largest permanent crops nursery in the U.S. Products include grapevines, almond trees, walnut rootstock, pistachio rootstock, stone fruit trees, citrus trees, cherry trees, pomegranate trees, blueberries, blackberries, olive trees, figs, and kiwis.

For more information, contact:
Duarte Nursery, Inc.
1555 Baldwin Rd., Hughson, CA 95326
tel: 209/531-0351; fax: 209/531-0352
e-mail: sales@duartenursery.com
website: www.duartenursery.com

PLEASE SEE DUARTE NURSERY AD, PAGE 21


Weed Badger® Model 4200

- On-the-go tilt
- Tractors 18-30 HP
- Exclusive R/E Control

We know you've been looking for affordable and reliable in-row weed control. So check out our line of models and options that will keep your vineyards in tip-top shape.

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Ice Wine Juice For Sale

CEDAR RIDGE VINEYARDS

For more information:
Jim Knowles
19277 Gore Rd.
Blenheim, ONT N0P 1A0
Canada

Tel: 519.676.5512
Fax: 519.676.5160

RANCH SYSTEMS LLC

Ranch Systems offers real-time, online microclimate weather stations, soil monitoring, and remote irrigation control for single or multi-ranch applications. Ranch Systems' wireless telemetry equipment and online software interacts with a variety of sensors to gather/transmit field information to a secure website for convenient viewing and management.

NEW additions in 2010 are GPS-enabled wireless nodes for agricultural asset tracking and precision agriculture, and interactive multi-property maps. A "private label" program provides partners with best-of-class telemetry technology for integration into their own solutions under their own brands.

With all Ranch Systems solutions, customers can view charts, set custom alerts and triggers, generate reports, and activate valves and equipment online, or download information to a spreadsheet for calculations.

Ranch Systems solutions work with a range of sensors including soil moisture, temperature, relative humidity, wind speed and direction, and rainfall, and also provide calculated measures such as powdery mildew index, and evapotranspiration (ETO).

Ranch Systems offers the *RanchCam* wireless camera to monitor crop development, prevent theft, view property access, or track wildlife, with an off-grid, solar-powered, and wireless system. The *RanchCam* works with Ranch Systems' base stations, to view images from anywhere in the world via an Internet connection.

Systems are modular, requiring zero programming for flexible and cost-effective coverage of multiple blocks or properties.

For more information, contact

Ranch Systems LLC
37 Commercial Blvd., Ste. 101
Novato, CA 94949
tel: 415/884-2770
website: www.ranchsystems.com

PLEASE SEE RANCH SYSTEMS AD, PAGE 25

CALIFORNIA SEED & PLANT LAB

California Seed and Plant Lab (Cal-SPL) located near Sacramento, CA, offers plant disease testing and genetic identification of grapevine varieties. The firm was established in 1995 and employs a highly qualified technical staff (Ph.D. and MS scientists).

Cal-SPL

Disease diagnosis: Cal-SPL offers a 17-virus PCR test to identify all viruses known to be present in California vineyards. Growers can identify healthy vines and start new plantings from healthy vines. Other economically important diseases including young vine decline (*Phaeoacremonium spp*) are also identified.

Virus elimination: Cal-SPL offers meristem services to eradicate virus infections from your favorite cultivar.

Soil health: Cal-SPL offers analysis of soil and enumerates beneficial microorganisms to such important pathogens as *Agrobacterium* (crown gall) and *Cylindrocarpon* (root rot). The analysis helps growers to choose a suitable organic amendment or compost tea to incorporate into soils for maximum yield.

Variety DNA identification: Genetic testing includes fingerprinting of varieties with an 8-marker DNA test. The fingerprint is compared with the varietal database (Cal-SPL has all varieties grown in California in the database). Fingerprinting service can also provide genetic profiling for patent applications.

For more information, contact:

California Seed & Plant Lab
7877 Pleasant Grove Rd., Elverta, CA 95626
Parm Randhawa, Ph.D.
tel: 916/655-1581; fax: 916/655-1582
e-mail: randhawa@calspl.com
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PLANTRA® GROW TUBES

PLANTRA®, a North American vine and tree establishment leader, is dedicated to designing products that overcome plant stress and unleash the full growth potential of planting stock. Reducing plant stress leads to accelerated vine and tree growth, slashing field establishment costs.

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PLANTRA® Grow Tubes' large, "plant-safe" 3.5 inch diameter, exclusive "Peach" color, and light-diffusing twin-wall construction grow the bottom line by:

- Automatically and uniformly guiding vines up to the cordon wire, saving multiple trips through the field to train vines;
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- Protecting young vines from animals, especially rabbits and deer, until safely trained on the cordon wire;
- Reducing vine stress, increasing survival rates, and dramatically reducing costly re-plants.

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CALENDAR

April 29–May 1, 2010
Hospice du Rhône (See page 58 for details)

May 6, 2010
Variety Focus 2010 Sauvignon Blanc
Freeborn Hall, UC Davis

Lectures will include information on the origin of Sauvignon blanc; its history in France and the New World; the importance, development, and selection of clones; and the role of Sauvignon blanc in the wines of France and regional wines from other areas, particularly California. See Page 86 [Jan/Feb-2010 ***PWV***] for more information, or visit www.extension.ucdavis.edu/wine

May 14–15, 2010
Anderson Valley Winegrowers' 13th Pinot Noir Festival
Philo, CA

Friday, May 14: day-long technical conference and educational seminar will be followed by a barbecue at Standish Wine Co.'s Day Ranch, with local foods and wines from around the state. Grand tasting is on Saturday afternoon at Goldeneye Winery. A Saturday afternoon ticket will be offered for consumers, with in-depth tastings, food and wine pairings, and presentations from local and guest vintners. Winemaker dinners offered on Saturday night at locations in Anderson Valley and on the Mendocino coast. Sunday, May 16 features open houses at Anderson Valley wineries. For more information, go to avwines.com.

June 20-22, 2010
7th International Cool Climate Viticulture & Enology Symposium
Seattle, WA (See page 56)

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European grapevine moth

Continued from page 13

parasites may have on moth populations. In France, Italy, and Spain, the highest parasitism is reported on the diapausing pupa stage. In Europe, green lacewings are among the main predators in summer and spiders are important predators of larvae and diapausing pupae.

Mating disruption — Female moths emit a plume of sex pheromone that males follow upwind to find females and mate. Scores of dispensers loaded with synthetic pheromone and deployed throughout a vineyard cause the air to become saturated with the pheromone, such that male moths are unable to locate females, preventing or delaying mating. In the absence of mating or if the female is too old when mated, viable eggs are not laid and no larvae are produced to damage grape clusters.

Mating disruption has proven most effective when European grapevine moth populations are low and when synthetic pheromone is applied to large areas of over 10 acres or area-wide. If moth populations are high, supplemental insecticide applications may be needed.

At press time, no pheromone dispenser product has been registered for use in the U.S., though at least one manufacturer is seeking registration with the U.S. Environmental Protection Agency. The pheromone product undergoing registration is a hand-applied dispenser that is attached to trellis wires or canes.

Mating disruption dispensers must be placed in the vineyard at the beginning of the male moth flight, as indicated by the first catch in pheromone traps. Follow manufacturer recommendations for the application rate of dispensers per acre.

Once mating disruption dispensers are registered for use and deployed in vineyards, the pheromone emitted by the dispensers coupled with the lure pheromone in the traps will cause very few moths to be caught in the traps (trap shutdown). Regardless, traps are useful to monitor a vineyard under mating disruption.

Place pheromone traps along the edges and in the center of the block. The edge traps give an indication of movement of male moths into the vineyard. The center traps should catch very few or no moths. If the center traps are catching males, then mating is not being disrupted and supplemental insecticide applications may be needed. Monitor eggs at peak trap catch and periodically sample grape clusters for the presence of worms or damage.

Sanitation

Sanitation of equipment will be critical to minimize movement of this insect from infested vineyards to non-infested vineyards and to avoid the spread to other regions of California. Equipment should be washed prior to leaving an infested property, preferably with a high-pressure sprayer and hot water. This is especially important for all machinery and containers that come in contact with fruit during harvest.

Larvae can hide in tight places, and fully formed larvae may form a cocoon and pupate in any protected place. When hiring an outside company to harvest fruit, verify that the contractor follows good sanitation practices. Loads will need to be covered during shipment to the winery, and winery waste that does not undergo fermentation will need to be composted. ■

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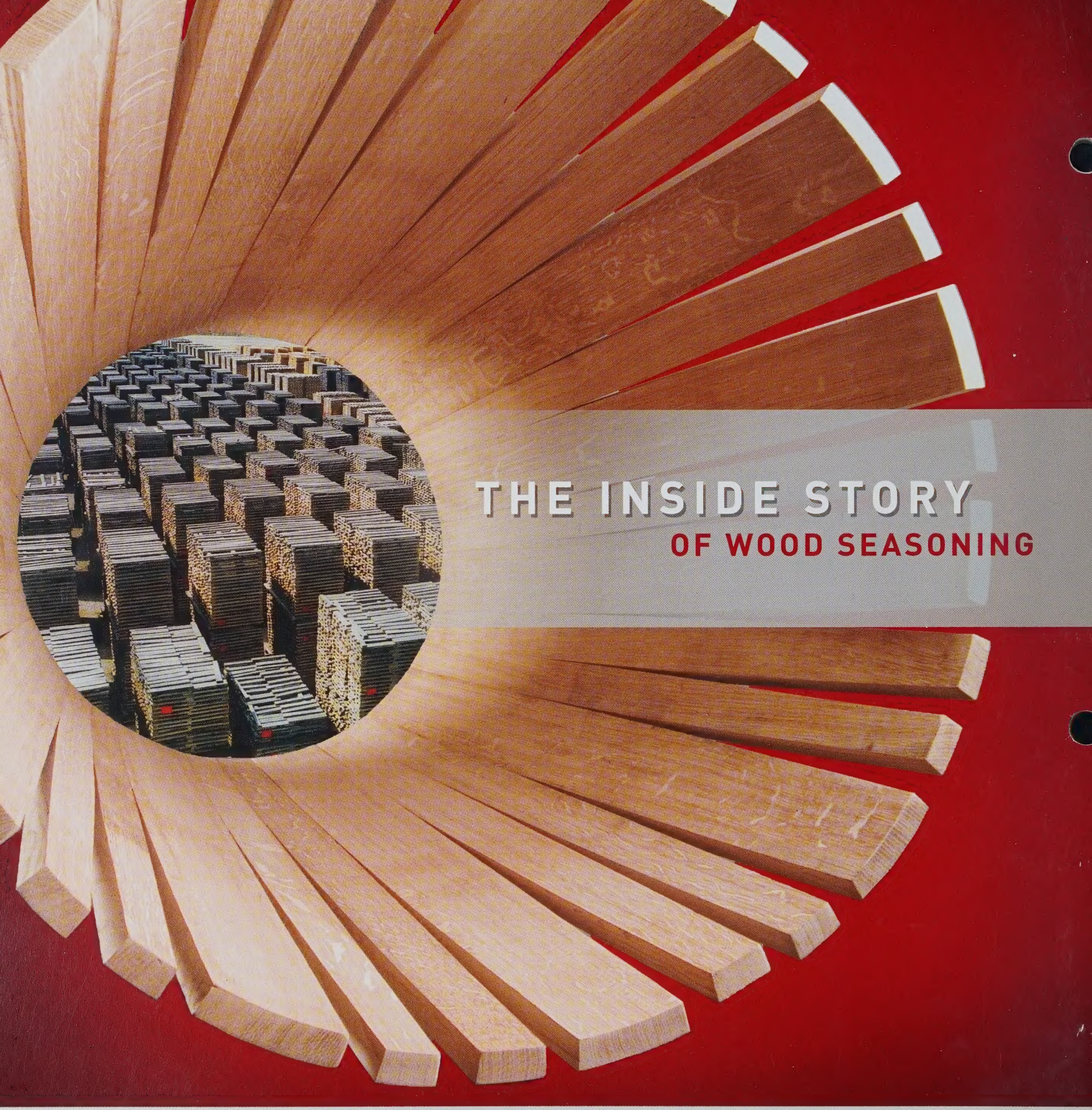

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